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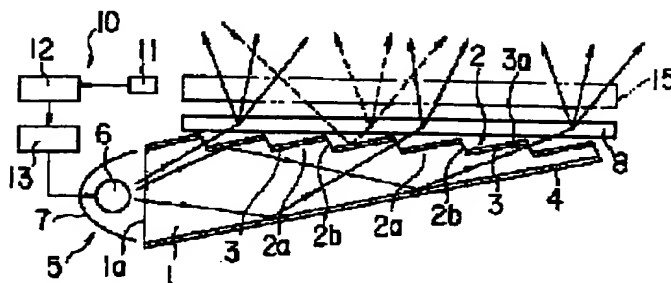
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TITLE : SURFACE LIGHT SOURCE DEVICE



ABSTRACT : PROBLEM TO BE SOLVED: To provide a surface light source device capable of emitting illumination light from a light source in the front and reflecting outside light coming from the front and emitting again it in the front.

SOLUTION: This surface light source device has a lightguide 1 forming the front in a stairs-shaped surface 2, taking in illumination light from an incident edge surface 1a and emitting from plural differential step surfaces 2b of the stairs-shaped surface 2; an outside light reflecting surface 3a installed on plural step surfaces 2a of the stairs-shaped surface 2 of the lightguide 1 and reflecting outside light coming from the front; a light source 5 installed on the side of the lightguide 1 so as to face the incident edge surface; and a light control plate 8 arranged in the front of the lightguide 1, taken in the outside light coming from the front, emitting it to the rear, taking in the outside light reflected with the outside light reflecting surface 3a from the rear, emitting it in the front, taking in illumination light coming from the plural differential step surfaces of the lightguide 1 from the rear, scattering the light, then emitting in the front.

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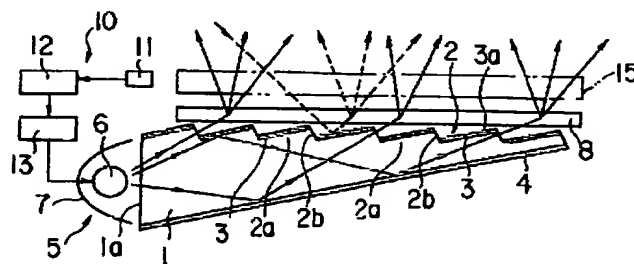
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(54)【発明の名称】 面光源装置

(57)【要約】

【課題】光源からの照明光を前方に出射するとともに、前方から入射する外光を反射して前方に出射することができる面光源装置を提供する。

【解決手段】前面が階段形状面2に形成されており、入射端面1aから照明光を取り込んで前記階段形状面2の複数の段差面2bから出射する導光体1と、前記導光体1の階段形状面2の複数の段面2a上に設けられ、前方から入射する外光を前方に反射する外光反射面3aと、前記導光体1の側方に前記入射端面に対向させて配置された光源5と、前記導光体1の前面側で配置され、前方から入射する外光を前面から取り込んで背面に出射し、前記外光反射面3aにより反射された前記外光の反射光を背面から取り込んで前面に出射するとともに、前記導光体1の前記複数の段差面2bから出射する前記照明光を背面から取り込み、その光を散乱させて前面に出射する光制御板8とを備えた。



【特許請求の範囲】

【請求項1】少なくとも一端面が入射端面とされ、前面が複数の段面およびこれらの段面をつなぐ複数の段差面とからなる階段形状面に形成されており、前記入射端面から照明光を取り込んで前記複数の段差面から出射する導光体と、前記導光体の前記段差面とは異なる面に設けられ、前方から入射する外光を前方に反射する外光反射面と、前記導光体の側方に前記入射端面に対向させて配置された光源と、前記導光体の前面に背面を対向させて配置され、前方から入射する外光を前面から取り込んで背面に出射し、前記外光反射面により反射された前記外光の反射光を背面から取り込んで前面に出射するとともに、前記導光体の前記複数の段差面から出射する前記照明光を背面から取り込み、その光を散乱させて前面に出射する光制御板とを備えたことを特徴とする面光源装置。

【請求項2】前記外光反射面は、前記導光体の前記複数の段面上にそれぞれ設けられた複数の反射膜により形成されていることを特徴とする請求項1に記載の面光源装置。

【請求項3】前記外光反射面は、前記導光体の背面全体に設けられた反射膜により形成されていることを特徴とする請求項1に記載の面光源装置。

【請求項4】前記光制御板は、その法線に対して所定方向に所定の角度で傾いた方向に沿った透過軸をもち、前記透過軸に沿った方向から所定の角度範囲内の入射角で入射する光を散乱させずに出射し、他の方向から入射する光を散乱させて出射する選択散乱特性を有しており、この光制御板が、その前面における前記法線に対する前記透過軸のずれ方向を、前記導光体の複数の段面の法線に対して前記導光体の入射端面方向に向けて配置されていることを特徴とする請求項1に記載の面光源装置。

【請求項5】前記光制御板は、一方向に沿った横長の透光層が薄膜状の散乱層を境界層として複数列互いに平行に形成されるとともに、その各透光層の両側面と前記散乱層との界面がそれぞれ前記光制御板の法線に対して所定方向に所定の角度で傾いた傾斜面となっており、前記透光層の両側面と前記散乱層との界面の傾き方向に沿った透過軸方向から所定の角度範囲内の入射角で前記透光層に入射する光を散乱させずに出射し、他の方向から前記透光層に入射する光を前記散乱層により散乱させて出射する特性を有しており、この光制御板が、その前面における前記法線に対する前記透過軸のずれ方向を、前記導光体の複数の段面の法線に対して前記導光体の入射端面方向に向けて配置されていることを特徴とする請求項1に記載の面光源装置。

【請求項6】前記光制御板の法線に対する前記透過軸の傾き角度が40～80度の範囲内であり、前記外光反射面が、前記光制御板の背面に対して、前記導光体の入射端面から遠ざかる方向に向かって前記光制御板の背面と

の間隔を狭めるように傾斜しており、前記光制御板の法線に対する前記外光反射面の傾き角度が60～80度の範囲内であることを特徴とする請求項4または5に記載の面光源装置。

【請求項7】前記光源は、この光源から出射する照明光の輝度を制御する照明輝度制御手段を備えており、前記外光反射面による外光の反射率と、前記照明輝度制御手段による前記照明光の輝度制御条件とが、面光源装置の前方に出射する光の輝度が外部の環境の照度に応じて予め定められた輝度範囲となるように設定されていることを特徴とする請求項1に記載の面光源装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、光源からの照明光を前方に出射する機能と、前方から入射する外光を反射させて前方に出射する機能とを兼ね備えた面光源装置に関するものである。

【0002】

【従来の技術】例えば液晶表示素子のような外部から入射する光の透過を制御して表示する非発光型表示体を備えた表示装置のバックライト等に用いられる面光源装置として、サイドライト型と呼ばれるものがある。

【0003】このサイドライト型の面光源装置は、従来、端面から光を取り込んでその光を前面に出射する導光板と、この導光板の光を取り込む端面の側方に配置された照明光を出射する光源とから構成されている。なお、前記光源には、直管状の蛍光ランプまたはネオン管、EL（エレクトロルミネセンス）発光体、複数のLED（発光ダイオード）を整列したLEDアレイ等が用いられている。

【0004】前記導光板には、一般に、アクリル系樹脂等からなる平板状の透明板が用いられており、その少なくとも一端面が、前記光源からの照明光を取り込む入射端面とされ、前面全体が、前記入射端面から取り込んだ光の出射面とされている。

【0005】この導光板は、前記光源からの照明光を前記入射端面から取り込み、その照明光を導光板の前面および背面と外気（空気）との界面により全反射させながら導光板長さ方向に導いて、その前面のほぼ全域から前方に出射する。

【0006】

【発明が解決しようとする課題】ところで、面光源装置をバックライトとする表示装置には、常に面光源装置からの照明光を利用して透過型表示を行なうものと、自然光や室内光等の外光を利用する反射型表示と前記面光源装置からの照明光を利用する透過型表示との両方の表示を行なう、いわゆる2ウェイ表示型のものがある。

【0007】前記2ウェイ表示装置は、十分な明るさの外光が得られるときは、前記面光源装置から照明光を出射させずに外光を利用する反射型表示を行ない、外光の

明るさが不足するときは、前記面光源装置から照明光を出射させて、外光を利用する反射型表示と前記面光源装置からの光を利用する透過型表示とを同時に行なうことにより、前記反射型表示による画面輝度の不足分を前記透過型表示により補い、また、外光が得られないときは、前記面光源装置からの光を利用する透過型表示を行なうものであり、この２ウェイ表示装置は、どのような明るさ的环境下でも表示を行なうことができるとともに、十分な明るさの外光が得られるときは前記面光源装置から照明光を出射させる必要がないため、常に面光源装置からの照明光を利用して透過型表示を行なうものに比べて、消費電力が少なくすむという利点をもっている。

【0008】しかし、従来の面光源装置は、導光板の側方に配置された光源からの照明光を前記導光板にその入射端面から取り込み、その照明光を前記導光板の前面から前方に出射するだけのものであるため、例えば上述した２ウェイ表示装置を構成するには、液晶表示素子等の非発光型表示体の背面に半透過反射板を配置し、この半透過反射板の背後に前記面光源装置を配置しなければならなかった。

【0009】この発明は、光源からの照明光を前方に出射するとともに、前方から入射する外光を反射させて前方に出射することができる面光源装置を提供することを目的としたものである。

【0010】

【課題を解決するための手段】この発明の面光源装置は、少なくとも一端面が入射端面とされ、前面が複数の段面およびこれらの段面をつなぐ複数の段差面とからなる階段形状面に形成されており、前記入射端面から照明光を取り込んで前記複数の段差面から出射する導光体と、前記導光体の前記段差面とは異なる面に設けられ、前方から入射する外光を前方に反射する外光反射面と、前記導光体の側方に前記入射端面に対向させて配置された光源と、前記導光体の前面に背面を対向させて配置され、前方から入射する外光を前面から取り込んで背面に出射し、前記外光反射面により反射された前記外光の反射光を背面から取り込んで前面に出射するとともに、前記導光体の前記複数の段差面から出射する前記照明光を背面から取り込み、その光を散乱させて前面に出射する光制御板とを備えたことを特徴とするものである。

【0011】すなわち、この発明の面光源装置は、その前方から入射し、前記光制御板にその前面から取り込まれてこの光制御板の背面に出射する外光を、前記外光反射面により反射し、その反射光を前記光制御板にその背面から取り込んでその前面から前方に出射するとともに、前記光源からの照明光を、前記導光体にその入射端面から取り込んでこの導光体の複数の段差面から出射し、その光を前記光制御板にその背面から取り込んで、この光制御板により散乱させてその前面から前方に出射

するものであり、この面光源装置によれば、光源からの照明光を前方に出射するとともに、前方から入射する外光を反射させて前方に出射することができる。

【0012】そのため、この面光源装置によれば、十分な明るさの外光が得られるときは、光源を点灯させずに外光の反射光だけを出射し、外光の明るさが不足するときは、前記光源を点灯させて外光の反射光と前記光源からの照明光の両方を出射することにより外光の反射光の輝度不足を前記照明光により補い、また、外光が得られないときは、前記光源からの照明光を出射することができる。

【0013】

【発明の実施の形態】この発明の面光源装置は、上記のように、入射端面から照明光を取り込んで階段形状面に形成された前面の複数の段差面から出射する導光体と、前記導光体の前記段差面とは異なる面に設けられた外光反射面と、前記導光体の側方に前記入射端面に対向させて配置された光源と、前記導光体の前面に背面を対向させて配置され、前方から入射する外光を前面から取り込んで背面に出射し、前記外光反射面により反射された前記外光の反射光を背面から取り込んで前面に出射するとともに、前記導光体の前記複数の段差面から出射する前記照明光を背面から取り込み、その光を散乱させて前面に出射する光制御板とを備えたことを特徴とするものであり、前記光源からの照明光を前方に出射するとともに、前方から入射する外光を反射させて前方に出射することができる。

【0014】この面光源装置によれば、十分な明るさの外光が得られるときは、光源を点灯させずに外光の反射光だけを出射し、外光の明るさが不足するときは、前記光源を点灯させて外光の反射光と前記光源からの照明光の両方を出射することにより外光の反射光の輝度不足を前記照明光により補い、また、外光が得られないときは、前記光源からの照明光を出射することができるため、例えば外光を利用する反射型表示と面光源装置からの照明光を利用する透過型表示との両方の表示を行なう２ウェイ表示装置を、半透過反射板を用いることなく構成することができる。

【0015】この面光源装置において、前記外光反射面は、前記導光体の複数の段面上にそれぞれ反射膜を設けるか、あるいは前記導光体の背面全体に反射膜を設けることにより、前記複数の段面上または導光体背面に形成するのが好ましく、このようにすることにより、前記光制御板の前方から入射する外光のほとんどをロス無く反射させ、その反射光を前記光制御板の前面全体から出射することができる。

【0016】さらに、前記光制御板は、例えば、その法線に対して所定方向に所定の角度で傾いた方向に沿った透過軸をもち、前記透過軸に沿った方向から所定の角度範囲内の入射角で入射する光を散乱させずに出射し、他

の方向から入射する光を散乱させて出射する選択散乱特性を有するものが好ましい。

【0017】また、前記光制御板は、一方向に沿った横長の透光層が薄膜状の散乱層を境界層として複数列互いに平行に形成されるとともに、その各透光層の両側面と前記散乱層との界面がそれぞれ前記光制御板の法線に対して所定方向に所定の角度で傾いた傾斜面となっており、前記透光層の両側面と前記散乱層との界面の傾き方向に沿った透過軸方向から所定の角度範囲内の入射角で前記透光層に入射する光を散乱させずに出射し、他の方向から前記透光層に入射する光を前記散乱層により散乱させて出射する特性を有するものでもよい。

【0018】そして、上記いずれかの特性を有する光制御板を用いる場合は、この光制御板を、その前面における前記法線に対する前記透過軸のずれ方向を、前記導光体の複数の段面の法線に対して前記導光体の入射端面方向に向けて配置するのが望ましい。

【0019】このように、上記いずれかの特性を有する光制御板を、前記導光体に対して上記のように配置すれば、前記導光体にその入射端面から取り込まれて前記複数の段差面から出射する照明光が、前記光制御板にその透過軸に対して交差する方向から入射するため、前記導光体の複数の段差面から出射する照明光のほとんどを、前記光制御板により散乱させて前方に出射することができる。

【0020】また、前記光制御板の前面から入射する外光のうち、この光制御板の透過軸方向から所定の角度範囲内の入射角で入射して散乱されることなく前記光制御板の背面に出射した光が、前記外光反射面により反射されて向きを変え、前記光制御板にその透過軸に対して交差する方向から入射して、この光制御板により散乱されてその前面に出射するとともに、他の方向から入射した外光が、前記光制御板により散乱されてその背面に出射し、前記外光反射面により様々な方向に反射されて、前記光制御板の散乱作用を受けてその前面に出射するため、前方から入射する外光のほとんどを散乱させて前方に出射することができる。

【0021】したがって、前記光源からの照明光も、前方から入射する外光の反射光も、広範囲に拡散させて前方に出射し、その出射光の輝度分布を広くすることができる。

【0022】この面光源装置において、前記外光反射面により反射され前記光制御板により散乱されてその前面に出射する反射光の主な出射方向は、前記光制御板の透過軸の向きや、前記外光反射面の傾き角度によって決まるが、前記光制御板を前記導光体に対して上記のように配置する場合、例えば前記光制御板の法線に対する前記透過軸の傾き角度を40～80度の範囲内とし、前記導光体の前記段差面とは異なる面に設けられた外光反射面を、前記光制御板の背面に対して、前記導光体の入射端

面から遠ざかる方向に向かって前記光制御板の背面との間隔を狭めるように傾斜させ、前記光制御板の法線に対する前記外光反射面の傾き角度を60～80度の範囲内に設定すれば、前記外光の反射光を、前記光制御板の法線に対して前記導光体の入射端面とは反対側の端面方向に5～60度傾いた方向に主に出射させることができる。

【0023】また、この面光源装置においては、前記光源に、この光源から出射する照明光の輝度を制御する照明輝度制御手段を備えさせ、前記外光反射面による外光の反射率と、前記照明輝度制御手段による前記照明光の輝度制御条件とを、面光源装置の前方に出射する光の輝度が外部の環境の照度に応じて予め定められた輝度範囲となるように設定するのが望ましく、このようにすることにより、充分な明るさの外光が得られる環境において光源を点灯させずに外光の反射光だけを出射するときも、外光の明るさが不足する環境において前記光源を点灯させて外光の反射光と前記光源からの照明光の両方を出射することにより外光の反射光の輝度不足を前記照明光により補うときも、また、外光が得られない環境において前記光源からの照明光を出射するときも、前記環境の照度に応じて、その環境照度に対して好適な輝度の光を出射することができる。

【0024】

【実施例】図1～図3はこの発明の第1の実施例を示しており、図1は面光源装置の側面図、図2は図1の一部分の拡大図である。

【0025】この実施例の面光源装置は、導光体1と、この導光体1の側方に配置された光源5と、前記導光体1の前面側に配置された光制御板8とを備えている。

【0026】前記導光体1は、アクリル系樹脂等からなる透明板であり、その一端面が前記光源3からの光を取り込む入射端面1aとされている。

【0027】また、この導光体1の前面は、前記入射端面1a側から他端側に向かって段階的に低くなる（導光体1の背面との間隔を狭める）ように形成された、互いに平行な複数の段面2aと、これらの段面2aをつなぐ複数の段差面2bとからなる微小ピッチの階段形状面2に形成されており、背面は平坦面となっている。

【0028】前記階段形状面2の複数の段面2aは、導光体1の背面とはほぼ平行で、かつ前記導光体1の幅方向（入射端面1aの長さ方向）に沿う横長の平坦面であり、これらの段面2aの上にはそれぞれ、その段面全体にわたってアルミニウムまたは銀等の高反射率金属の蒸着膜からなる鏡面反射膜3が設けられており、これらの反射膜3により外光反射面3aが形成されている。

【0029】また、前記階段形状面の複数の段差面2bは、前記段面2aに対して90度またはそれよりも僅かに大きい角度で立ち上がる極く小さい高さの立ち上がり面であり、これらの段差面2bがそれぞれ、前記入射端

面1aから導光体1内に取り込まれた照明光の出射面となっている。

【0030】さらに、前記導光体1の背面には、その背面全体にわたって、アルミニウムまたは銀等の高反射率金属の蒸着膜からなる鏡面反射膜4が設けられている。

【0031】この導光体1は、その側方に配置された光源5からの照明光を前記入射端面1aから取り込み、その光を導光体前面の階段形状面2の複数の段差面2bから出射するとともに、前方から入射する外光を、前記階段形状面2の複数の段面2a上に設けられた反射膜3からなる外光反射面3aにより前方に向けて反射する。

【0032】また、前記光源5は、前記導光体1の入射端面1aに向けて照明光を出射するものであり、直管状の蛍光灯またはネオン管、EL（エレクトロルミネセンス）発光体、複数のLED（発光ダイオード）を整理したLEDアレイ等の発光体6と、この発光体6からの放射光を反射させるリフレクタ7とからなっており、この光源5は、前記導光体1の側方に、その入射端面1aに対向させて配置されている。

【0033】一方、前記導光板1の前面側に配置された光制御板8は、その前方から入射する外光を前面から取り込んで背面に出射し、前記導光体1の複数の段面2a上の外光反射面3aにより反射された前記外光の反射光を背面から取り込んで前面に出射するとともに、前記導光体1の前記複数の段差面2bから出射する前記照明光を背面から取り込み、その光を散乱させて前面に出射する機能をもっている。

【0034】図3は前記光制御板8の一部分の側面図であり、この光制御板8は、その法線Hに対して所定方向に所定の角度 θ で傾いた方向に沿った透過軸Pをもち、前記透過軸Pに沿った方向から所定の角度範囲 ϕ 内の入射角で入射する光を透過させ、他の方向からの入射光を散乱させる選択散乱特性を有する光学フィルムからなっている。以下、この光制御板8を、選択散乱フィルムという。

【0035】この選択散乱フィルム8は、その一方の面から入射して他方の面に出射する光に対しても、前記他方の面から入射して前記一方の面に出射する光に対しても同じ選択散乱特性を示し、図3に矢線で示したように、前記透過軸Pに沿った方向から所定の角度範囲 ϕ 内の入射角で入射する光を散乱させることなく透過させて反対面に出射し、他の方向からの入射光を散乱させて反対面に出射する。

【0036】そして、この実施例では、前記選択散乱フィルム8を、図1および図2に示したように、前記導光体1の前面側に、その階段形状面2の複数の段面2aの先端縁にフィルム背面を近接または当接させるとともに、フィルム前面における前記法線Hに対する前記透過軸Pのずれ方向を、前記導光体1の複数の段面2aの法線hに対して前記導光体1の入射端面1a方向に向けて

配置している。

【0037】すなわち、前記導光体1と前記選択散乱フィルム8とは、前記導光体1の階段形状面2の複数の段面2aの先端縁を通る仮想面（図示せず）と前記選択散乱フィルム8の背面とが互いに平行になる位置関係で配置されている。

【0038】そのため、前記導光体1の前記複数の段面2a上の外光反射面3aは、前記選択散乱フィルム8の背面に対して、前記導光体1の入射端面1aから遠ざかる方向に向かって前記選択散乱フィルム8の背面との間隔を狭めるように傾斜しており、また、前記段面2aに対して90度またはそれよりも僅かに大きい角度で立ち上がる段差面2bは、前記選択散乱フィルム8の背面に対して斜め方向から向き合っている。

【0039】また、この面光源装置においては、図1に示したように、前記光源5に、この光源5から出射する照明光の輝度を制御する照明輝度制御手段10を備えさせている。

【0040】この照明輝度制御手段10は、外部の環境（面光源装置の使用環境）の照度を測定する照度検出器11と、この照度検出器11により測定された環境照度に基づいて前記光源5の発光体6が出射する照明光の輝度を制御する手段とからなっており、前記照明光の輝度を制御する手段は、輝度調整回路12と、光源点灯回路13とからなっている。

【0041】なお、前記照度検出器11は、面光源装置にその前方から入射する外光の照度と同じ環境照度を測定するように、受光面を面光源装置の前面（選択散乱フィルム8の前面）とほぼ平行にして配置されている。

【0042】また、前記輝度調整回路12は、前記照度検出器11により測定された環境照度に基づいて、前記光源5から出射させる照明光の輝度を、面光源装置の前方に出射する出射光の輝度が環境照度に応じて予め定められた輝度範囲となるように調整するものであり、前記光源点灯回路13は、前記光源5の発光体6を、前記輝度調整回路12からの輝度値に応じた輝度の照明光を出射するように駆動する。

【0043】そして、この面光源装置においては、前記外光反射面3aによる外光の反射率（反射膜3の反射率）と、前記照明輝度制御手段10による前記照明光の輝度制御条件とを、面光源装置の前方に出射する光の輝度が外部の環境の照度に応じて予め定められた輝度範囲となるように設定している。

【0044】上記面光源装置は、前記光源5からの照明光を前方に出射するとともに、前方から入射する外光を反射させて前方に出射するものであり、前記光源5は、前方から入射する外光の反射光だけでは十分な輝度の出射光が得られないときに点灯される。

【0045】まず、光源5からの照明光の出射経路について説明すると、前記光源5からの照明光は、その経路

を図1に実線で示したように、前記導光体1にその入射端面1aから取り込まれ、この導光体1内をその長さ方向に導かれる。

【0046】そして、前記導光体1内をその長さ方向に向かって導かれる照明光のうち、導光体前面の複数の段差面2bのいずれかに直接向かう光は、その段差面2bから導光体1の前面側に射出する。

【0047】また、前記段差面2bに直接向かう光以外の光、つまり、導光体前面の複数の段面2aに向かって進む光や、導光体1の背面に向かって進む光は、前記段面2a上の反射膜3および導光体背面の反射膜4で反射されて向きを変え、その繰り返しにより導光体1内をその長さ方向に導かれながら、前記複数の段差面2bのいずれかに入射して、その段差面2bから射出する。

【0048】そのため、前記導光体1にその入射端面1aから取り込まれた照明光のほとんどが、ロス無く前記複数の段差面2bから射出する。

【0049】そして、前記導光体1の前方に射出した照明光は、この導光体1の前面に背面を対向させて配置された前記選択散乱フィルム8に、その背面から入射する。

【0050】このとき、前記選択散乱フィルム8は、その背面を前記導光体1の複数の段面2aの先端縁に近接または当接させて配置されており、また、前記導光体1の複数の段差面2bは、前記選択散乱フィルム8の背面に対して斜め方向から向き合っているため、前記導光体1の複数の段差面2bから射出した光のほとんどが、ロス無く選択散乱フィルム8にその背面から取り込まれる。

【0051】また、前記選択散乱フィルム8は、上述したように、フィルム前面における前記法線Hに対する前記透過軸Pのずれ方向を、前記導光体1の複数の段面2aの法線hに対して前記導光体1の入射端面1a方向に向けて配置されているため、前記導光体1の複数の段差面2bから射出した照明光は、前記選択散乱フィルム8にその透過軸Pに対して交差する方向から入射する。

【0052】そして、前記選択散乱フィルム8は、図3に示したように、その透過軸Pに沿った方向から所定の角度範囲内の入射角で入射する光を透過させ、他の方向からの入射光を散乱させる選択散乱特性を有しているため、前記導光体1の複数の段差面から射出し、前記選択散乱フィルム8にその透過軸Pに対して交差する方向から入射した照明光のほとんどが、前記選択散乱フィルム8により散乱されてその前面から前方に射出する。

【0053】次に、前方から入射する外光の射出経路について説明すると、前方から入射した外光は、その経路を図1に破線で示したように、前記選択散乱フィルム8にその前面から取り込まれる。

【0054】この場合、外光は、様々な方向から様々な入射角で入射するため、前記選択散乱フィルム8の前面

から入射する外光のうち、この選択散乱フィルム8の透過軸P方向から所定の角度範囲内の入射角で入射した外光は、前記選択散乱フィルム8を散乱されることなく透過してその背面に射出し、他の方向から入射した外光は、前記選択散乱フィルム8により散乱されてその背面に射出する。

【0055】そして、前記選択散乱フィルム8を散乱されることなく透過してその背面に射出した光は、前記導光体1の複数の段面2a上の外光反射面3aにより反射されて向きを変え、前記選択散乱フィルム8にその透過軸Pに対して交差する方向から入射して、この選択散乱フィルム8により散乱されてその前面に射出する。

【0056】また、前記他の方向から入射し、前記選択散乱フィルム8により散乱されてその背面に射出した光は、図にはその経路を示していないが、前記外光反射面3aにより様々な方向に反射され、その反射光が前記選択散乱フィルム8の散乱作用を受けてその前面に射出する。

【0057】なお、前記選択散乱フィルム8により散乱されてその背面に射出した光は、前記外光反射面3aに様々な入射角で入射し、この反射面3aへの入射角に応じて様々な方向に反射されるため、その反射光のなかには、前記選択散乱フィルム8に対してその透過軸P方向から所定の角度範囲内の入射角で入射する光もあり、その反射光は、前記選択散乱フィルム8を散乱されることなく透過してその前面に射出する。

【0058】上記外光の反射において、前記外光反射面3aは、前記導光体1の複数の段面2a上にそれぞれその段面全体にわたって設けた反射膜3により形成されているため、前記選択散乱フィルム8の前方から入射する外光のほとんどをロス無く反射させ、その反射光を前記選択散乱フィルム8の前面全体から射出することができる。

【0059】すなわち、前記反射膜3は、前記導光体1の複数の段面2a上にだけ設けられているが、前記複数の段面2aの間の段差面2bは、前記段面2aに対して90度またはそれよりも僅かに大きい角度で立ち上がる極く小さい高さの立ち上がり面であるため、複数の段面2a上にそれぞれ設けられた複数の反射膜3の間隔は極く小さく、したがって、前記外光反射面3aは、前方から入射する外光のほとんどを反射させる。

【0060】なお、前方から入射し、前記選択散乱フィルム8により散乱された外光のなかには、この選択散乱フィルム8の背面から前記導光体1の段差面2bに向かって射出する光もあり、その光は前記段差面2bから導光体1に入射するが、この導光体1に入射した外光は、導光体1の背面において前記反射膜4により反射され、前記複数の段差面2bのいずれかから射出して、前記外光反射面3aによる反射光とともに前方に射出する。

【0061】このように、上記面光源装置は、その前方

から入射し、前記選択散乱フィルム8にその前面から取り込まれてこの選択散乱フィルム8の背面に出射する外光を、前記導光体1の複数の段面2b上の外光反射面3aにより反射し、その反射光を前記選択散乱フィルム8にその背面から取り込んでその前面から前方に出射するとともに、前記光源5からの照明光を、前記導光体1にその入射端面1aから取り込んでこの導光体1の複数の段差面2bから出射し、その光を前記選択散乱フィルム8にその背面から取り込んで、この選択散乱フィルム8により散乱させてその前面から前方に出射するものであり、この面光源装置によれば、光源5からの照明光を前方に出射するとともに、前方から入射する外光を反射させて前方に出射することができる。

【0062】そのため、この面光源装置によれば、十分な明るさの外光が得られるときは、光源5を点灯させずに外光の反射光だけを出射し、外光の明るさが不足するときは、前記光源5を点灯させて外光の反射光と前記光源5からの照明光の両方を出射することにより外光の反射光の輝度不足を前記照明光により補い、また、外光が得られないときは、前記光源5からの照明光を出射することができる。

【0063】しかも、前記選択散乱フィルム8は、上述したように、その法線Hに対して所定方向に所定の角度 θ で傾いた方向に沿った透過軸Pをもち、前記透過軸Pに沿った方向から所定の角度範囲 ϕ 内の入射角で入射する光を透過させ、他の方向からの入射光を散乱させる選択散乱特性を有しており、この選択散乱フィルム8が、前記導光体1の前面側に、フィルム前面における前記法線Hに対する前記透過軸Pのずれ方向を、前記導光体1の複数の段面2aの法線hに対して前記導光体1の入射端面1a方向に向けて配置されているため、前記導光体1にその入射端面1aから取り込まれてこの導光板1の複数の段差面2bから出射する照明光が、前記選択散乱フィルム8にその透過軸Pに対して交差する方向から入射する。

【0064】そのため、上記面光源装置によれば、前記導光体1の複数の段差面2bから出射する照明光のほとんどを、前記選択散乱フィルム8により散乱させてその前面から前方に出射することができる。

【0065】また、前記選択散乱フィルム8の前面から入射する外光のうち、この選択散乱フィルム8の透過軸P方向から所定の角度範囲 ϕ 内の入射角で入射して散乱されることなく前記選択散乱フィルム8の背面に出射した光が、前記外光反射面3aにより反射されて向きを変え、前記選択散乱フィルム8にその透過軸Pに対して交差する方向から入射して、この選択散乱フィルム8により散乱されてその前面に出射するとともに、他の方向から入射した外光が、前記選択散乱フィルム8により散乱されてその背面に出射し、前記外光反射面3aにより様々な方向に反射されて、前記選択散乱フィルム8の散乱

作用を受けてその前面に出射するため、前方から入射する外光のほとんどを散乱させて前方に出射することができる。

【0066】したがって、上記面光源装置によれば、光源5からの照明光も、前方から入射する外光の反射光も、広範囲に拡散させて前方に出射し、その出射光の輝度分布を広くすることができる。

【0067】さらに、上記面光源装置によれば、前記導光体1にその入射端面1aから取り込んだ照明光を、この導光体1の前面の前記複数の段差面2bから出射させるようにし、前記導光体1の前記複数の段差面とは異なる複数の段面2a上に反射膜3を設けて前記外光反射面3aを形成しているため、前記光源5から出射し前記導光体1により導かれて前記複数の段差面2bから出射する照明光の出射率と、前記外光反射面3aによる外光の反射率とを、それぞれ独自に選ぶことが可能であり、したがって、前記照明光の出射率を高くして光源5からの照明光の利用効率を上げるとともに、前記外光反射面3aによる外光の反射率を高くして外光の利用効率を上げることができる。

【0068】また、上記面光源装置においては、前記光源5に、この光源5から出射する照明光の輝度を制御する照明輝度制御手段10を備えさせ、前記外光反射面3aによる外光の反射率と、前記照明輝度制御手段10による前記照明光の輝度制御条件とを、面光源装置の前方に出射する光の輝度が外部の環境の照度に応じて予め定められた輝度範囲となるように設定しているため、低照度から高照度の広い照度範囲の環境において、その環境照度に対して好適な輝度の光を出射することができる。

【0069】すなわち、面光源装置が出射する出射光の好適な輝度は、外部の環境の照度によって異なり、出射光の輝度が同じでも、環境の照度によっては出射光が眩しすぎたり暗すぎたりする。

【0070】そのため、この実施例では、前記外光反射面3aの反射率（反射膜3の反射率）を、例えば夏の直射日光下のような10000ルクスを越える高照度の環境下でも眩しすぎない好適な輝度の出射光が得られるように設定し、また、前記外光反射面3aにより反射される外光の反射光と、前記光源5からの照明光との両方による出射輝度（ただし、環境照度がほとんど0ルクスであるときは、照明光のみによる出射輝度）が、環境照度に応じた好適な輝度になるように、前記光源5から出射させる照明光の輝度を、環境照度に応じて前記照明輝度制御手段10により制御するようにしている。

【0071】したがって、上記面光源装置によれば、十分な明るさの外光が得られる環境において光源5を点灯させずに外光の反射光だけを出射するときも、外光の明るさが不足する環境において前記光源5を点灯させて外光の反射光と前記光源5からの照明光の両方を出射することにより外光の反射光の輝度不足を前記照明により補

うときも、また、外光が得られない環境において前記光源5からの照明光を出射するときも、前記環境の照度に応じて、その環境照度に対して好適な輝度の光を出射することができる。

【0072】しかも、上記面光源装置は、充分な明るさの外光が得られる環境では光源5を点灯させなくても外光の反射光だけで環境照度に対して好適な輝度の光を出射することができ、また、外光の明るさが不足する環境において前記光源5を点灯させて外光の反射光と前記光源5からの照明光の両方を出射することにより外光の反射光の輝度不足を前記照明により補うときも、外光の反射光と前記照明光との両方による出射輝度が、環境照度に対して好適な輝度になるように前記光源5から出射させる照明光の輝度を制御すればよい。前記光源5の消費電力は少なくてもよい。

【0073】上記面光源装置は、例えば、外光を利用する反射型表示と面光源装置からの照明光を利用する透過型表示との両方の表示を行なう2ウェイ表示装置に利用されるものであり、この面光源装置は、光源5からの照明光を前方に出射するとともに、前方から入射する外光を反射して前方に出射することができるものであるため、前記2ウェイ表示装置を、半透過反射板を用いることなく構成することができる。

【0074】すなわち、上記面光源装置を用いて2ウェイ表示装置を構成する場合は、この面光源装置の前面側に、図1に仮想線（二点鎖線）で示したように、液晶表示素子等の非発光型表示体15を配置するだけでよい。

【0075】この2ウェイ表示装置は、半透過反射板を必要としないため、面光源装置からの照明光も、前方から入射する外光も効率良く利用して、明るい画像を表示することができる。

【0076】すなわち、半透過反射板を用いる2ウェイ表示装置は、面光源装置からの照明光が、前記半透過反射板の反射／透過特性に応じた透過率でこの半透過反射板を透過して表示体15にその背面から入射し、また、前記表示体15の前方から入射した外光が、前記半透過反射板の反射／透過特性に応じた反射率でこの半透過反射板を透過して前記表示体15にその背面から入射するため、面光源装置からの照明光も、前方から入射する外光も、効率良く利用することができない。

【0077】これに対して、上記実施例の面光源装置を用いる2ウェイ表示装置は、前記面光源装置が、理論的には、光源5からの光をほぼ100%の出射効率で出射するとともに、前方から入射する外光もほぼ100%の反射効率で反射するものであり、しかも半透過反射板を必要としないため、面光源装置からの照明光も、前方から入射する外光も効率良く利用して、明るい画像を表示することができる。

【0078】また、この2ウェイ表示装置は、前記面光源装置が、光源5からの照明光も、前方から入射する外

光の反射光も、輝度分布の広い光として出射するため、広い視野角をもっている。

【0079】なお、図1では、便宜上、導光体1の階段形状面2を大きく拡大して示したが、前記階段形状面2の段差面2bのピッチは小さい方がよい。

【0080】すなわち、例えば前記非発光型表示体15にドットマトリックス型の液晶表示素子を用いる場合は、前記導光体1の階段形状面2の段差面2bのピッチを、前記液晶表示素子の画素ピッチとほぼ同じか、あるいは画素ピッチの数倍程度にするのが好ましい。

【0081】このようにすれば、光源3からの照明光が前記導光体1の複数の段差面2bから上記ピッチで出射し、その光が選択散乱フィルム8により散乱されてほぼ均一な輝度分布の光となって出射するため、前記液晶表示素子の全ての画素部に入射させ、画素の欠け落ちの無い良好な画像を表示させることができる。

【0082】また、前記2ウェイ表示装置は、通常の反射型液晶表示装置と同様に、外光が得られる環境下では、画面の法線に対して画面の上縁側（図1において左側）に傾いた方向から主に外光を取り込むように画面の向きを選んで使用され、その表示は、前記画面の法線に対して画面の下縁方向（図1において右方向）に5～60度傾いた方向から観察される。

【0083】したがって、上記面光源装置を用いて2ウェイ表示装置を構成する場合は、面光源装置を、外光の反射光（散乱光）の主な出射方向が、前記選択散乱フィルム8の法線Hに対して一方向に5～60度傾いた方向になるように設計し、この面光源装置を、その外光の反射光の主な出射方向を表示装置の表示の観察方向に向けて配置するのが望ましい。

【0084】すなわち、上記面光源装置における、前記外光反射面3aにより反射され前記選択散乱フィルム8により散乱されてその前面に出射する反射光の主な出射方向は、前記選択散乱フィルム8の透過軸Pの向きや、前記外光反射面3aの傾き角度によって決まる。

【0085】そして、図2に示したように、前記選択散乱フィルム8を、その前面における選択散乱フィルム8の法線Hに対する透過軸Pのずれ方向を、前記導光体1の複数の段面2aの法線hに対して前記導光体1の入射端面1a方向に向けて配置する場合は、例えば前記選択散乱フィルム8の法線Hに対する前記透過軸Pの傾き角度 θ を40～80度の範囲内とし、前記導光体1の複数の段面2b上に設けられた反射膜3からなる外光反射面3aを、前記選択散乱フィルム8の背面に対して、前記導光体1の入射端面1aから遠ざかる方向に向かって前記選択散乱フィルム8の背面との間隔を狭めるように傾斜させ、前記選択散乱フィルム8の法線Hに対する前記外光反射面3aの傾き角度 α を60～80度の範囲内に設定すれば、前記外光の反射光を、その主な出射方向を図2に破線Fで示したように、前記選択散乱フィルム8

の法線Hに対して前記導光体1の入射端面1aとは反対側の端面方向に主に射出させるとともに、その射出角度（選択散乱フィルム8の法線Hに対する角度） γ を、5～60度の範囲にすることができる。

【0086】なお、前記選択散乱フィルム8の法線Hに対する前記外光反射面3aの傾き角度 α は、前記選択散乱フィルム8の背面に対する前記外光反射面3aの傾き角度（選択散乱フィルム8の法線Hと外光反射面3aの法線hとのずれ角） β に対して、 $\alpha + \beta = 90$ 度の関係にあるため、上記の方向に外光の反射光を主に射出させるようにするには、前記選択散乱フィルム8を、その法線Hを前記導光体1の複数の段面2aの法線hに対して前記導光体1の入射端面1aとは反対方向に10～30°傾けて配置すればよい。

【0087】さらに、前記面光源装置は、光源5に、この光源5から射出する照明光の輝度を制御する照明輝度制御手段10を備えさせ、前記外光反射面3aによる外光の反射率と、前記照明輝度制御手段10による前記照明光の輝度制御条件とを、面光源装置の前方に射出する光の輝度が外部の環境の照度に応じて予め定められた輝度範囲となるように設定したものであるため、この面光源装置を用いた上記2ウェイ表示装置は、低照度から高照度の広い照度範囲の使用環境において、その環境照度に対して好適な画面輝度の表示を得ることができる。

【0088】なお、上記2ウェイ表示装置では、前方から入射する外光が前記表示体15を透過して面光源装置に入射し、また、前記面光源装置からの射出光（外光が得られる環境では外光の反射光または前記外光の反射光と光源5からの照明光との両方、外光が得られない環境では光源5からの照明光）が前記表示体15を透過してその前方に射出するため、画面輝度は、前記面光源装置の外光反射面3aによる外光の反射率および光源5からの照明光の輝度と、前記表示体15の透過率とによって決まる。

【0089】したがって、前記面光源装置を2ウェイ表示装置に用いるときは、前記外光反射面3aによる外光の反射率と、前記照明輝度制御手段10による前記照明光の輝度制御条件とを、前記画面輝度が外部の環境の照度に応じて予め定められた輝度範囲となるように設定すればよい。

【0090】すなわち、環境照度に応じた好適な画面輝度は、例えば夜間の街灯化のような50ルクスの環境照度で20～200ニット、昼間や夜間の室内照明を点灯させたときの室内のような1000ルクスの環境照度で30～300ニット、晴天時の木陰のような3000ルクスの環境照度で400～4000ニットである。

【0091】したがって、前記面光源装置を2ウェイ表示装置に用いるときは、前記光源5からの照明光の輝度を、照明輝度制御手段10により、環境照度に対する画面輝度が、50ルクスの環境照度で20～200ニット

ト、1000ルクスの環境照度で30～300ニット、3000ルクスの環境照度で400～4000ニットの範囲をそれぞれ満足する二次関数で表わされる輝度となるように、環境照度に応じて制御すればよい。

【0092】なお、上記実施例では、導光体1の背面に反射膜4を設けているが、この背面の反射膜4は省略してもよく、この反射膜4が無くても、前記導光体1にその入射端面1aから取り込んだ照明光を、導光体背面と外気（空気）との界面で全反射させて導光体1の長さ方向に導くことができる。

【0093】また、上記実施例では、導光体1の前面側に配置する光制御板として、図2に示した選択散乱特性を有する選択散乱フィルム8を用いたが、前記光制御板は、前記選択散乱フィルム8に限らず、前方から入射する外光を前面から取り込んで背面に射出し、前記外光反射面3aにより反射された前記外光の反射光を背面から取り込んで前面に射出するとともに、前記導光体1の複数の段差面2bから射出する照明光を背面から取り込み、その光を散乱させて前面に射出する機能を有するものであればよい。

【0094】図4は、他の光制御板の一部分の側面図であり、この光制御板9は、ルーバー状の光学フィルムからなっている。以下、この光制御板9を、ルーバーフィルムという。

【0095】このルーバーフィルム9は、一方向に沿った横長な透光層9aが薄膜状の散乱層9bを境界層として複数列互いに平行に形成されたものであり、その各透光層9aの両側面と前記散乱層9bとの界面がそれぞれフィルムの法線H'に対して所定方向に所定の角度 θ' で傾いた傾斜面となっている。なお、前記透光層9aは、無色の透明樹脂等からなっており、前記散乱層9bは、白色の透明樹脂等からなっている。

【0096】このルーバーフィルム9は、前記透光層9aの両側面と前記散乱層9bとの界面の傾き方向に沿った透過軸P'をもっており、その透過軸P'方向から所定の角度範囲内の入射角 ϕ' で前記透光層9aに入射する光を散乱させずに射出し、他の方向から前記透光層9aに入射する光を前記散乱層9bにより散乱させて射出する特性を有している。

【0097】このルーバーフィルム9は、その一方の面から入射して他方の面に射出する光に対しても、前記他方の面から入射して前記一方の面に射出する光に対しても同じ散乱特性を示し、図4に矢線で示したように、前記透過軸P'に沿った方向から前記透光層20に、隣り合う散乱層9bのうちの一方の散乱層9bの一端縁（フィルム前面側の端縁）と他方の散乱層9bの他端縁（フィルム背面側の端縁）とを通る直線と、前記一方の散乱層9bの他端縁（フィルム背面側の端縁）と他方の散乱層9bの一端縁（フィルム前面側の端縁）とを通る直線とがなす角度範囲の入射角 ϕ' で入射する光を散乱させ

ることなく透過させて反対面に出射し、他の方向からの入射光を散乱させて反対面に出射する。

【0098】このルーバーフィルム9を用いる場合も、上記実施例と同様に、前記ルーバーフィルム9を、導光体1の前面側に、その階段形状面2の複数の段面2aの先端縁にフィルム背面を近接または当接させるとともに、フィルム前面における前記法線H'に対する前記透過軸P'のずれ方向を、前記導光体1の複数の段面2aの法線hに対して前記導光体1の入射端面1a方向に向けて配置すればよい。

【0099】このように、前記ルーバーフィルム9を導光体1に対して上記のように配置すれば、前記導光体1にその入射端面1aから取り込まれて前記複数の段差面2bから出射する照明光が、前記ルーバーフィルム9にその透過軸P'に対して交差する方向から入射するため、前記導光体1の複数の段差面2bから出射する照明光のほとんどを、前記ルーバーフィルム9により散乱させて前方に出射することができる。

【0100】また、前記ルーバーフィルム9の前面から入射する外光のうち、このルーバーフィルム9の透過軸P'方向から所定の角度範囲内の入射角 ϕ' で入射して散乱されることなく前記ルーバーフィルム9の背面に出射した光が、前記外光反射面3aにより反射されて向きを変え、前記ルーバーフィルム9にその透過軸P'に対して交差する方向から入射して、このルーバーフィルム9により散乱されてその前面に出射するとともに、他の方向から入射した外光が、前記ルーバーフィルム9により散乱されてその背面に出射し、前記外光反射面3aにより様々な方向に反射されて、前記ルーバーフィルム9の散乱作用を受けてその前面に出射するため、前方から入射する外光のほとんどを散乱させて前方に出射することができる。

【0101】したがって、前記光源5からの照明光も、前方から入射する外光の反射光も、広範囲に拡散させて前方に出射し、その出射光の輝度分布を広くすることができる。

【0102】また、前記ルーバーフィルム9を用いる場合も、前記外光反射面3aにより反射され前記ルーバーフィルム9により散乱されてその前面に出射する反射光の主な出射方向は、前記ルーバーフィルム9の透過軸P'の向きや、前記外光反射面3aの傾き角度によって決まるが、前記ルーバーフィルム9を前記導光体1に対して上記のように配置する場合、例えば前記ルーバーフィルム9の法線H'に対する前記透過軸P'の傾き角度を40～80度の範囲内とし、前記外光反射面3aを前記ルーバーフィルム9の背面に対して、前記導光体1の入射端面1aから遠ざかる方向に向かって前記ルーバーフィルム9の背面との間隔を狭めるように傾斜させ、前記ルーバーフィルム9の法線H'に対する前記外光反射面3aの傾き角度を60～80度の範囲内に設定すれ

ば、前記外光の反射光を、前記ルーバーフィルム9の法線H'に対して前記導光体1の入射端面1aとは反対側の端面方向に5～60度傾いた方向に主に出射させることができる。

【0103】また、上記第1の実施例では、導光体1の複数の段面2aの上に反射膜3を設け、これらの反射膜3により外光反射面3aを形成しているが、外光の反射面は、前記導光体1の照明光出射面である複数の段差面2bとは異なる面であれば、他の面に形成してもよい。

【0104】図5はこの発明の第2の実施例を示す面光源装置の側面図であり、この実施例では、前記導光板1の階段形状面2の複数の段面2a上に反射膜を設けずに、これらの段面2aを光透過面とし、前記導光体1の背面に、その背面全体にわたって、アルミニウムまたは銀等の高反射率金属の蒸着膜からなる鏡面反射膜4を設けて、この反射膜4により外光反射面4aを形成している。

【0105】なお、この実施例は、導光板1の複数の段面2aを光透過面とし、前記導光体1の背面に外光反射面4aを形成したものであるが、前記導光体の他の構成は上述した第1の実施例と同じであり、また光源5および照明輝度制御手段10も前記第1の実施例と同じ構成であり、さらに導光体1の前面側に配置した光制御板も、上述した選択散乱フィルム8またはルーバーフィルム9であるから、重複する説明は図に同符号を付して省略する。

【0106】この実施例の面光源装置によれば、前記導光体1の背面全体に外光反射面4aを形成しているため、前記光制御板（選択散乱フィルム8またはルーバーフィルム9）の前方から入射する外光のほとんどを、さらにロス無く反射させ、その反射光を前記光制御板8、9の前面全体から出射することができる。

【0107】また、この実施例においても、前記導光体1の照明光出射面である複数の段差面2bとは異なる面（導光体背面）に反射膜4を設けて前記外光反射面4aを形成しているため、前記光源5から出射し前記導光体1により導かれて前記複数の段差面2bから出射する照明光の出射率と、前記外光反射面4aによる外光の反射率とを、それぞれ独自に選ぶことが可能であり、したがって、前記照明光の出射率を高くして光源5からの照明光の利用効率を上げるとともに、前記外光反射面4aによる外光の反射率を高くして外光の利用効率を上げることができる。

【0108】なお、上記面光源装置は、2ウェイ表示装置に限らず、例えば、側方に配置した光源からの光と前方から入射する外光とを利用する照明パネル等として広く利用することができる。

【0109】さらに、上記実施例では、導光板1の一端面を入射端面1aとしたが、前記導光板1は、例えば、両端の端面を入射端面とし、前面を、両端側から導光体

の中間部に向かって段階的に低くなる階段形状面に形成した、長さ方向の中間部をはさんで左右対称な形状のものでもよい。

【0110】このような構成の導光体を用いる場合は、この導光体の両端の入射端面の側方にそれぞれ光源を配置するとともに、前記導光体の前面側に、長さ方向の中間部をはさんで左右対称な散乱特性を有する配置する光制御板を配置すればよい。

【0111】

【発明の効果】この発明の面光源装置は、入射端面から照明光を取り込んで階段形状面に形成された前面の複数の段差面から出射する導光体と、前記導光体の前記段差面とは異なる面に設けられた外光反射面と、前記導光体の側方に前記入射端面に対向させて配置された光源と、前記導光体の前面に背面に対向させて配置され、前方から入射する外光を前面から取り込んで背面に出射し、前記外光反射面により反射された前記外光の反射光を背面から取り込んで前面に出射するとともに、前記導光体の前記複数の段差面から出射する前記照明光を背面から取り込み、その光を散乱させて前面に出射する光制御板とを備えたことを特徴とするものであるから、前記光源からの照明光を前方に出射するとともに、前方から入射する外光を反射させて前方に出射することができる。

【0112】この面光源装置によれば、十分な明るさの外光が得られるときは、光源を点灯させずに外光の反射光だけを出射し、外光の明るさが不足するときは、前記光源を点灯させて外光の反射光と前記光源からの照明光の両方を出射することにより外光の反射光の輝度不足を前記照明光により補い、また、外光が得られないときは、前記光源からの照明光を出射することができるため、例えば外光を利用する反射型表示と面光源装置からの照明光を利用する透過型表示との両方の表示を行なう2ウェイ表示装置を、半透過反射板を用いることなく構成することができる。

【0113】この面光源装置において、前記外光反射面は、前記導光体の複数の段面上にそれぞれ反射膜を設けるか、あるいは前記導光体の背面全体に反射膜を設けることにより、前記複数の段面上または導光体背面に形成するのが好ましく、このようにすることにより、前記光制御板の前方から入射する外光のほとんどをロス無く反射させ、その反射光を前記光制御板の前面全体から出射することができる。

【0114】さらに、前記光制御板は、例えば、その法線に対して所定方向に所定の角度で傾いた方向に沿った透過軸をもち、前記透過軸に沿った方向から所定の角度範囲内の入射角で入射する光を散乱させずに出射し、他の方向から入射する光を散乱させて出射する選択散乱特性を有するものが好ましい。

【0115】また、前記光制御板は、一方向に沿った横長な透光層が薄膜状の散乱層を境界層として複数列互い

に平行に形成されるとともに、その各透光層の両側面と前記散乱層との界面がそれぞれ前記光制御板の法線に対して所定方向に所定の角度で傾いた傾斜面となっており、前記透光層の両側面と前記散乱層との界面の傾き方向に沿った透過軸方向から所定の角度範囲内の入射角で前記透光層に入射する光を散乱させずに出射し、他の方向から前記透光層に入射する光を前記散乱層により散乱させて出射する特性を有するものでもよい。

【0116】そして、上記いずれかの特性を有する光制御板を用いる場合は、この光制御板を、その前面における前記法線に対する前記透過軸のずれ方向を、前記導光体の複数の段面の法線に対して前記導光体の入射端面方向に向けて配置するのが望ましい。

【0117】このように、上記いずれかの特性を有する光制御板を、前記導光体に対して上記のように配置すれば、前記導光体にその入射端面から取り込まれて前記複数の段差面から出射する照明光が、前記光制御板にその透過軸に対して交差する方向から入射するため、前記導光体の複数の段差面から出射する照明光のほとんどを、前記光制御板により散乱させて前方に出射することができる。

【0118】また、前記光制御板の前面から入射する外光のうち、この光制御板の透過軸方向から所定の角度範囲内の入射角で入射して散乱されることなく前記光制御板の背面に出射した光が、前記外光反射面により反射されて向きを変え、前記光制御板にその透過軸に対して交差する方向から入射して、この光制御板により散乱されてその前面に出射するとともに、他の方向から入射した外光が、前記光制御板により散乱されてその背面に出射し、前記外光反射面により様々な方向に反射されて、前記光制御板の散乱作用を受けてその前面に出射するため、前方から入射する外光のほとんどを散乱させて前方に出射することができる。

【0119】したがって、前記光源からの照明光も、前方から入射する外光の反射光も、広範囲に拡散させて前方に出射し、その出射光の輝度分布を広くすることができる。

【0120】この面光源装置において、前記外光反射面により反射され前記光制御板により散乱されてその前面に出射する反射光の主な出射方向は、前記光制御板の透過軸の向きや、前記外光反射面の傾き角度によって決まるが、前記光制御板を前記導光体に対して上記のように配置する場合、例えば前記光制御板の法線に対する前記透過軸の傾き角度を40～80度の範囲内とし、前記導光体の前記段差面とは異なる面に設けられた外光反射面を、前記光制御板の背面に対して、前記導光体の入射端面から遠ざかる方向に向かって前記光制御板の背面との間隔を狭めるように傾斜させ、前記光制御板の法線に対する前記外光反射面の傾き角度を60～80度の範囲内に設定すれば、前記外光の反射光を、前記光制御板の法

線に対して前記導光体の入射端面とは反対側の端面方向に5〜60度傾いた方向に主に出射させることができる。

【0121】また、この面光源装置においては、前記光源に、この光源から出射する照明光の輝度を制御する照明輝度制御手段を備えさせ、前記外光反射面による外光の反射率と、前記照明輝度制御手段による前記照明光の輝度制御条件とを、面光源装置の前方に出射する光の輝度が外部の環境の照度に応じて予め定められた輝度範囲となるように設定するのが望ましく、このようにすることにより、十分な明るさの外光が得られる環境において光源を点灯させずに外光の反射光だけを出射するときも、外光の明るさが不足する環境において前記光源を点灯させて外光の反射光と前記光源からの照明光の両方を出射することにより外光の反射光の輝度不足を前記照明光により補うときも、また、外光が得られない環境において前記光源からの照明光を出射するときも、前記環境の照度に応じて、その環境照度に対して好適な輝度の光を出射することができる。

【図面の簡単な説明】

【図1】この発明の第1の実施例を示す面光源装置の側面図。

【図2】図1の一部分の拡大図。

【図3】前記面光源装置に用いた光制御板の一部分の側面図

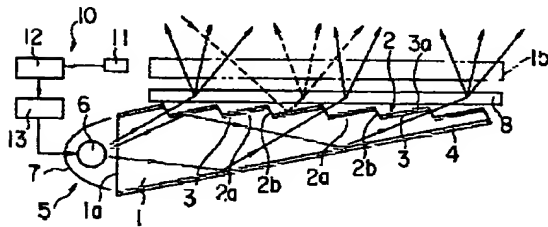
【図4】他の光制御板の一部分の側面図

【図5】この発明の第2実施例を示す面光源装置の側面図。

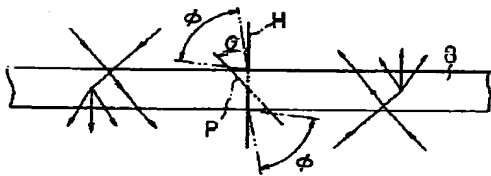
【符号の説明】

- 1…導光体
- 1a…入射端面
- 2…階段形状面
- 2a…段面
- 2b…段差面
- 3, 4…反射膜
- 3a, 4a…外光反射面
- 5…光源
- 8…光制御板（選択散乱フィルム）
- 9…光制御板（ルーバーフィルム）
- 10…照明輝度制御手段

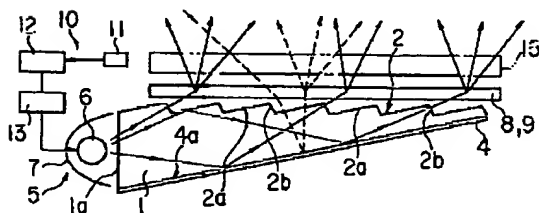
【図1】



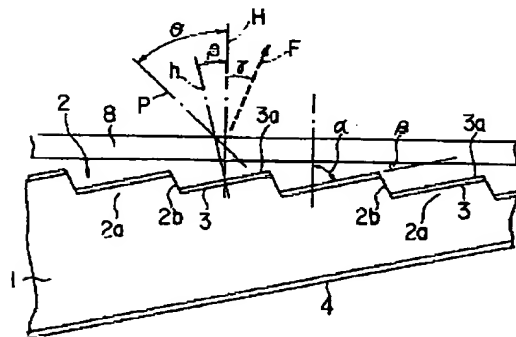
【図3】



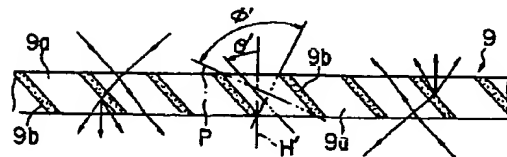
【図5】



【図2】



【図4】



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Notes:

1. Untranslatable words are replaced with asterisks (****).
2. Texts in the figures are not translated and shown as it is.

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CLAIMS

[Claim(s)]

[Claim 1] The transparent material which an end side is made into incidence ****, s formed in the echelon form-like side which consists of two or more level difference sides where the front connects two or more **** and these **** at east, takes in the illumination light from said incidence ****, and is emitted from said two or more level difference sides, The outdoor daylight reflective surface which reflects ahead the outdoor daylight which is prepared in a different field from said level difference side of said transparent material, and enters from the front, Make the back counter the light source which said incidence **** was made to counter the side of said transparent material, and has been arranged, and the front of said transparent material, and it is arranged. While taking in the outdoor daylight which enters from the front from the front, acting to the back as Idei, taking in the catoptric light of said outdoor daylight reflected by said outdoor daylight reflective surface from the back and being emitted to the front Field light equipment characterized by having the Optical Control Sub-Division board which said illumination light emitted from said two or more level difference sides of said transparent material is taken in from the back, and the light is scattered, and is emitted to the front.

[Claim 2] Said outdoor daylight reflective surface is field light equipment according to claim 1 characterized by being formed with two or more reflective films prepared on said two or more **** of said transparent material, respectively.

[Claim 3] Said outdoor daylight reflective surface is field light equipment according to claim 1 characterized by being formed with the reflective film prepared in the whole back of said transparent material.

[Claim 4] Said Optical Control Sub-Division board has the transmission axis which net in the direction which inclined in the predetermined direction at an angle of predetermined to the ****. It acts as Idei, without scattering the light which enters by the incidence angle of predetermined angle within the limits from the direction in alignment with said transmission axis. It has the selection dispersion characteristic which the entering light is scattered and is emitted from other directions. Field light equipment according to claim 1 characterized by arranging this Optical Control Sub-Division board towards the incidence **** direction of

said transparent material to **** of two or more **** of said transparent material in the gap direction of said transmission axis over the aforementioned method line in that front.

Claim 5] [the board / a scattering layer with an oblong filmy photic region along one way] while two or more rows of said Optical Control Sub-Division board are mutually formed in parallel as a boundary layer The interface of the both-sides side of each of that photic region and said scattering layer forms a slope which inclined in the predetermined direction at an angle of predetermined to **** of said Optical Control Sub-Division board, respectively. It acts as Idei, without scattering the light which enters into said photic region by the incidence angle of predetermined angle within the limits from [which met in the inclination direction of the interface of the both-sides side of said photic region, and said scattering layer] a transmission axis. It has the characteristic of scattering the light which enters into said photic region by said scattering layer, and emitting it from other directions. Field light equipment according to claim 1 characterized by arranging this Optical Control Sub-Division board towards the incidence **** direction of said transparent material to **** of two or more **** of said transparent material in the gap direction of said transmission axis over the aforementioned method line in that front.

[Claim 6] Are within the limits whose inclination angle of said transmission axis over **** of said Optical Control Sub-Division board is 40 to 80 degrees, and said outdoor daylight reflective surface receives the back of said Optical Control Sub-Division board. Field light equipment according to claim 4 or 5 which inclines so that an interval with the back of said Optical Control Sub-Division board may be narrowed toward the direction which keeps away from incidence **** of said transparent material, and is characterized by being within the limits whose inclination angle of said outdoor daylight reflective surface over **** of said Optical Control Sub-Division board is 60 to 80 degrees.

[Claim 7] The reflectance of outdoor daylight said light source is equipped with a Lighting Sub-Division luminosity control means to control the luminosity of the illumination light emitted from this light source, and according to said outdoor daylight reflective surface, Field light equipment according to claim 1 characterized by setting up the luminosity control condition of said illumination light by said Lighting Sub-Division luminosity control means so that the luminosity of the light emitted ahead of field light equipment may serve as a luminosity range beforehand defined according to the illumination of external environment.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the field light equipment which combines the function to emit the illumination light from a light source ahead, and

the function which is made to reflect the outdoor daylight which enters from the front, and is emitted ahead.

[0002]

Description of the Prior Art] For example, there are some which are called a sidelight type as field light equipment used for the backlight of the display device equipped with the nonluminescent type display object which controls and displays the penetration of the entering light from the outside like a liquid-crystal-display element etc.

[0003] This sidelight type field light equipment consists of light sources which emit the illumination light arranged in the side of **** which takes in the light of the light guide plate which takes in light from **** and emits that light to the front, and this light guide plate conventionally. In addition, a direct tubular fluorescence lamp or a direct tubular neon bulb, EL (electro LUMINE sense) photogen, the LED array that aligned two or more LED(s) (light emitting diode), etc. are used for said light source.

[0004] Generally the plate-like transparent board which consists of acrylic resin etc. is used for said light guide plate, it is considered as the incidence **** from which an end side takes in the illumination light from said light source at least, and the whole front is made into the side of the light taken in from said incidence ***.

[0005] leading this light guide plate in the light guide plate length direction, taking in the illumination light from said light source from said incidence ****, and carrying out total internal reflection of that illumination light according to the interface of the front of a light guide plate and the back, and the open air (air) -- that front -- it is mostly emitted ahead from the whole region.

[0006]

[Problem to be solved by the invention] by the way, [field light equipment / the display device made into backlight] There is a what is called 2 way display type thing which displays both what always performs a penetrated type display using the illumination light from field light equipment, the reflected type display using outdoor daylight, such as available light and indoor light, and the penetrated type display using the illumination light from said field light equipment.

[0007] [said 2 way display device] when the outdoor daylight of sufficient brightness is obtained When the reflected type display which uses outdoor daylight without acting as side of the illumination light from said field light equipment is performed and the brightness of outdoor daylight runs short By acting as side of the illumination light from said field light equipment, and performing simultaneously the reflected type display using outdoor daylight, and the penetrated type display using the light from said field light equipment When the insufficiency of the screen luminosity by said reflected type display is compensated by said penetrated type display and outdoor daylight is not obtained Perform the penetrated type display using the light from said field light equipment, and [this 2 way display device] While being able to display under the environment

of any brightness When the outdoor daylight of sufficient brightness is obtained, in order not to act as Idei of the illumination light from said field light equipment, it has the advantage that there is little power consumption and it ends compared with what always performs a penetrated type display using the illumination light from field light equipment.

[0008] However, since conventional field light equipment takes into said light guide plate the illumination light from the light source arranged in the side of a light guide plate from the incidence **** and is only what emits the illumination light ahead from the front of said light guide plate, For example, in order to have constituted 2 way display device mentioned above, the transflective light reflector must be arranged at the back of nonluminescent type display objects, such as a liquid-crystal-display element, and said field light equipment must be arranged behind this transflective light reflector.

[0009] This invention aims at offering the field light equipment which can be made to be able to reflect the outdoor daylight which enters from the front, and can be emitted ahead while it emits the illumination light from a light source ahead.

[0010]

[Means for solving problem] An end side is made into incidence **** at least, and the field light equipment of this invention is formed in the echelon form-like side where the front consists of two or more level difference sides which connect two or more **** and these ****. The transparent material which takes in the illumination light from said incidence ****, and is emitted from said two or more level difference sides, The outdoor daylight reflective surface which reflects ahead the outdoor daylight which is prepared in a different field from said level difference side of said transparent material, and enters from the front, Make the back counter the light source which said incidence **** was made to counter the side of said transparent material, and has been arranged, and the front of said transparent material, and it is arranged. While taking in the outdoor daylight which enters from the front from the front, acting to the back as Idei, taking in the catoptric light of said outdoor daylight reflected by said outdoor daylight reflective surface from the back and being emitted to the front It is characterized by having the Optical Control Sub-Division board which said illumination light emitted from said two or more level difference sides of said transparent material is taken in from the back, and the light is scattered, and is emitted to the front.

[0011] [namely, the outdoor daylight which the field light equipment of this invention enters from that front, is taken into said Optical Control Sub-Division board from that front, and is emitted to the back of this Optical Control Sub-Division board] While reflecting according to said outdoor daylight reflective surface, taking the catoptric light into said Optical Control Sub-Division board from the back and being ahead emitted from the front Take the illumination light from said light source into said transparent material from that incidence ****, act as Idei from two or more level difference sides of this transparent material, and that light is taken into said Optical Control Sub-Division board from that back.

You make it scattered about with this Optical Control Sub-Division board, and it is ahead emitted from that front, and according to this field light equipment, while emitting the illumination light from a light source ahead, the outdoor daylight which enters from the front can be reflected and it can be emitted ahead.

0012] When [therefore,] the outdoor daylight of sufficient brightness is obtained according to this field light equipment When it acts as Idei only of the catoptric light of outdoor daylight, without making a light source turn on and the brightness of outdoor daylight runs short When the shortage of luminosity of the catoptric light of outdoor daylight is compensated by said illumination light and outdoor daylight is not obtained by making said light source turn on and emitting both illumination light from the catoptric light and said light source of outdoor daylight, the illumination light from said light source can be emitted.

0013] Mode for carrying out the invention] The transparent material emitted from two or more level difference sides of the front which the field light equipment of this invention took in the illumination light from incidence **** as mentioned above, and was formed in the echelon form-like side, The outdoor daylight reflective surface established in a different field from said level difference side of said transparent material, and the light source which said incidence **** was made to counter the side of said transparent material, and has been arranged, While make the back counter the front of said transparent material, and it is arranged, and taking in the outdoor daylight which enters from the front from the front, acting to the back as Idei, taking in the catoptric light of said outdoor daylight reflected by said outdoor daylight reflective surface from the back and being emitted to the front While taking in from the back said illumination light emitted from said two or more level difference sides of said transparent material, being characterized by having the Optical Control Sub-Division board which the light is scattered and is emitted to the front and emitting the illumination light from said light source ahead [The outdoor daylight which enters from the front can be reflected and it can be emitted ahead.

0014] When the outdoor daylight of sufficient brightness is obtained according to this field light equipment When it acts as Idei only of the catoptric light of outdoor daylight, without making a light source turn on and the brightness of outdoor daylight runs short When the shortage of luminosity of the catoptric light of outdoor daylight is compensated by said illumination light and outdoor daylight is not obtained by making said light source turn on and emitting both the catoptric light of outdoor daylight, and the illumination light from said light source Since the illumination light from said light source can be emitted, 2 way display device which displays both the reflected type display using outdoor daylight and the penetrated type display using the illumination light from field light equipment can be constituted without using a transfective light reflector.

0015] In this field light equipment, [said outdoor daylight reflective surface] By preparing a reflective film on **** of the plurality of said transparent material,

respectively, or preparing a reflective film in the whole back of said transparent material. It is desirable to form in two or more said **** top or the transparent material back, by doing in this way, most outdoor daylight which enters from the front of said Optical Control Sub-Division board can be reflected without loss, and the catoptric light can be emitted from the whole front of said Optical Control Sub-Division board.

[0016] Furthermore, said Optical Control Sub-Division board has the transmission axis which met in the direction which inclined in the predetermined direction at an angle of predetermined to the ****, for example. What has the selection dispersion characteristic which it acts as Idei, without scattering the light which enters by the incidence angle of predetermined angle within the limits from the direction in alignment with said transmission axis, and the light which enters from other directions is scattered, and is emitted is desirable.

[0017] Moreover, [the board / a scattering layer with an oblong filmy photic region along one way] while two or more rows of said Optical Control Sub-Division board are mutually formed in parallel as a boundary layer. The interface of the both-sides side of each of that photic region and said scattering layer forms a slope which inclined in the predetermined direction at an angle of predetermined to **** of said Optical Control Sub-Division board, respectively. It may act as Idei, without scattering the light which enters into said photic region by the incidence angle of predetermined angle within the limits from [which met in the inclination direction of the interface of the both-sides side of said photic region, and said scattering layer] a transmission axis, and may have the characteristic of scattering the light which enters into said photic region from other directions by said scattering layer, and emitting it.

[0018] And when using the Optical Control Sub-Division board which has the characteristic of one of the above, it is desirable to arrange the gap direction of said transmission axis over the aforementioned method line [in / for this Optical Control Sub-Division board / that front] towards the incidence **** direction of said transparent material to **** of two or more **** of said transparent material.

[0019] Thus, if the Optical Control Sub-Division board which has the characteristic of one of the above is arranged as mentioned above to said transparent material. Since the illumination light which it is taken into said transparent material from the incidence ****, and is emitted from said two or more level difference sides enters from the direction which intersects said Optical Control Sub-Division board to the transmission axis, Most illumination light emitted from two or more level difference sides of said transparent material can be scattered with said Optical Control Sub-Division board, and it can be emitted ahead.

[0020] [moreover, the light which acted to the back of said Optical Control Sub-Division board as Idei without being entered and scattered about by the incidence angle of predetermined angle within the limits from / of this Optical Control Sub-

Division board / a transmission axis from the front of said Optical Control Sub-Division board among the entering outdoor daylight] While it is reflected by said outdoor daylight reflective surface, changing direction, entering from the direction which intersects said Optical Control Sub-Division board to that transmission axis, being scattered about with this Optical Control Sub-Division board and emitted to that front Since it is scattered about with said Optical Control Sub-Division board, and it acts to the back as Idei, it is reflected in the various directions by said outdoor daylight reflective surface and the outdoor daylight which entered from other directions is emitted to the front in response to a dispersion operation of said Optical Control Sub-Division board, most outdoor daylight which enters from the front can be scattered, and it can be emitted ahead.

[0021] Therefore, the illumination light from said light source and the catoptric light of the outdoor daylight which enters from the front can be diffused broadly, and it can act ahead as Idei, and they can make large luminance distribution of the outgoing radiation light.

[0022] [the directions] although the main outgoing radiation directions of the catoptric light which is reflected by said outdoor daylight reflective surface, is scattered about with said Optical Control Sub-Division board in this field light equipment, and is emitted to that front are decided by direction of the transmission axis of said Optical Control Sub-Division board, and the inclination angle of said outdoor daylight reflective surface When arranging said Optical Control Sub-Division board as mentioned above to said transparent material, the inclination angle of said transmission axis over **** of said Optical Control Sub-Division board is carried out within the limits of 40 to 80 degrees. In the outdoor daylight reflective surface established in a different field from said level difference side of said transparent material, the back of said Optical Control Sub-Division board is received. If it is made to incline so that an interval with the back of said Optical Control Sub-Division board may be narrowed toward the direction which keeps away from incidence **** of said transparent material and the inclination angle of said outdoor daylight reflective surface over **** of said Optical Control Sub-Division board is set up within the limits of 60 to 80 degrees It can be made to mainly act in the direction which inclined in the **** direction by the side of opposite 5 to 60 degrees to incidence **** of said transparent material as Idei of the catoptric light of said outdoor daylight to **** of said Optical Control Sub-Division board.

[0023] Moreover, the reflectance of outdoor daylight make a Lighting Sub-Division luminosity control means to control the luminosity of the illumination light emitted to said light source from this light source in this field light equipment have, and according to said outdoor daylight reflective surface, When it is desirable to set up so that the luminosity of the light emitted ahead of field light equipment may serve as a luminosity range beforehand defined according to the illumination of external environment and it carries out the luminosity control condition of said

illumination light by said Lighting Sub-Division luminosity control means in this way Also when emitting only the catoptric light of outdoor daylight, without making a light source turn on in the environment where the outdoor daylight of sufficient brightness is obtained Also when compensating the shortage of luminosity of the catoptric light of outdoor daylight by said illumination light by making said light source turn on in the environment which runs short of the brightness of outdoor daylight, and emitting both illumination light from the catoptric light and said light source of outdoor daylight Moreover, also when emitting the illumination light from said light source in the environment where outdoor daylight is not obtained, according to the illumination of said environment, the light of suitable luminosity can be emitted to the environmental illumination.

[0024]

[Working example] Drawing 1 – drawing 3 show the 1st example of this invention, drawing 1 is the side view of field light equipment, and drawing 2 is some enlarged drawings of drawing 1 .

[0025] The field light equipment of this example is equipped with the transparent material 1, the light source 5 arranged in the side of this transparent material 1, and the Optical Control Sub-Division board 8 arranged at the front side of said transparent material 1.

[0026] Said transparent material 1 is a transparent board which consists of acrylic resin etc., and is made into incidence **** 1a from which the end side takes in the light from said light source 3.

[0027] Moreover, **** 2a to which the front of this transparent material 1 becomes low gradually toward said incidence **** 1a side to the other end side (the interval, the back of a transparent material 1, is narrowed), which was formed like and which is parallel plurality mutually, It is formed in the echelon form-like side 2 of the minute pitch which consists of two or more level difference sides 2b which connect these **** 2a, and the back is a flat side.

[0028] Two or more **** 2a of said echelon form-like side 2 are almost parallel to the back of a transparent material 1. And it is the oblong flat side which meets crosswise [of said transparent material 1] (the length direction of incidence **** 1a). On these **** 2a, the specular reflexion film 3 which consists of a vapor deposition film of high reflectance metal, such as aluminum or silver, over the whole **** is formed, respectively, and the outdoor daylight reflective surface 3a is formed with these reflective films 3.

[0029] [moreover, two or more level difference sides 2b of said echelon form-like side] **** which rises from 90 degrees or it at a slightly large angle to said **** 2a — it is the standup side of small height and these level difference sides 2b are the Idei sides of the illumination light taken in from said incidence **** 1a in the transparent material 1, respectively.

[0030] Furthermore, it migrates to the whole back and the specular reflexion film 4 which consists of a vapor deposition film of high reflectance metal, such as aluminum or silver, is formed in the back of said transparent material 1.

[0031] While this transparent material 1 takes in the illumination light from the light source 5 arranged in that side from said incidence **** 1a and emitting that light from two or more level difference sides 2b of the echelon form-like side 2 of the front of a transparent material It reflects towards the front according to the outdoor daylight reflective surface 3a which consists of a reflective film 3 in which the entering outdoor daylight was prepared on two or more **** 2a of said echelon form-like side 2 from the front.

[0032] Moreover, said light source 5 is what emits the illumination light towards incidence **** 1a of said transparent material 1. The photogens 6, such as a direct tubular fluorescence lamp or a direct tubular neon bulb, EL (electroluminescence) photogen, and a LED array that aligned two or more LED(s) (light emitting diode), It consists of a reflector 7 made to reflect the synchrotron orbital radiation from this photogen 6, and this light source 5 makes the side of said transparent material 1 counter that incidence **** 1a, and is arranged.

[0033] [the Optical Control Sub-Division board 8 arranged at the front side of said light guide plate 1] on the other hand While taking in the outdoor daylight which enters from the front from the front, acting to the back as Idei, taking in the catoptric light of said outdoor daylight reflected by the outdoor daylight reflective surface 3a on two or more **** 2a of said transparent material 1 from the back and being emitted to the front Said illumination light emitted from said two or more level difference sides 2b of said transparent material 1 is taken in from the back, and it has the function which the light is scattered and is emitted to the front.

[0034] Drawing 3 is some side views of said Optical Control Sub-Division board 8, and [this Optical Control Sub-Division board 8] Have the transmission axis P which met in the direction which inclined in the predetermined direction at an angle of [theta] predetermined to the **** H, the light which enters by the incidence angle in the predetermined angle range phi from the direction in alignment with said transmission axis P is made to penetrate, and it consists of an optical film which has the selection dispersion characteristic of scattering the incidence light from other directions. This Optical Control Sub-Division board 8 is hereafter called selection dispersion film.

[0035] Also as opposed to the light which this selection dispersion film 8 enters from the field of one of these, and is emitted to the field of another side As the same selection dispersion characteristic is shown also to the light which enters from the field of said another side and is emitted to one [said] field and the arrow showed to drawing 3 It is made to penetrate, without scattering the light which enters by the incidence angle in the predetermined angle range phi from the direction in alignment with said transmission axis P, and acts to an opposite side as Idei, the incidence light from other directions is scattered, and it is emitted to an opposite side.

[0036] And [this example / said selection dispersion film 8] while making the film back approach or contact the tip edge of two or more **** 2a of that echelon

orm-like side 2 at the front side of said transparent material 1 as shown in drawing 1 and drawing 2 The gap direction of said transmission axis P over the forementioned method line H in the front of a film is arranged towards the direction of incidence **** 1a of said transparent material 1 to **** h of two or more **** 2a of said transparent material 1.

[0037] That is, said transparent material 1 and said selection dispersion film 8 are arranged by the physical relationship to which the virtual side (not shown) passing through the tip edge of two or more **** 2a of the echelon form-like side 2 of said transparent material 1 and the back of said selection dispersion film 8 become parallel mutually.

[0038] [therefore, the outdoor daylight reflective surface 3a on said two or more **** 2a of said transparent material 1] To the back of said selection dispersion film 8, it inclines so that an interval with the back of said selection diffusion film 8 may be narrowed toward the direction which keeps away from incidence **** 1a of said transparent material 1. Moreover, the level difference side 2b which rises from 90 degrees or it at a slightly large angle to said **** 2a has faced each other from across to the back of said selection diffusion film 8.

[0039] Moreover, a Lighting Sub-Division luminosity control means 10 to control the luminosity of the illumination light emitted to said light source 5 from this light source 5 is made to have in this field light equipment, as shown in drawing 1 .

[0040] The illumination detector 11 with which this Lighting Sub-Division luminosity control means 10 measures the illumination of external environment (the environment of field light equipment), It consists of a means to control the luminosity of the illumination light which the photogen 6 of said light source 5 emits based on the environmental illumination measured by this illumination detector 11, and a means to control the luminosity of said illumination light consists of a brilliance control circuit 12 and a light source lighting circuit 13.

[0041] In addition, an acceptance surface is mostly made parallel with the front (front of the selection dispersion film 8) of field light equipment, and said illumination detector 11 is arranged so that the same environmental illumination as the illumination of the outdoor daylight which enters into field light equipment from the front may be measured.

[0042] Moreover, said brilliance control circuit 12 is based on the environmental illumination measured by said illumination detector 11. It is what is adjusted so that it may become the luminosity range as which the luminosity of the outgoing radiation light which emits the luminosity of the illumination light which acts as Idei ahead of field light equipment was beforehand determined according to environmental illumination from said light source 5. Said light source lighting circuit 13 is driven so that the illumination light of the luminosity [photogen / 6 / of said light source 5] according to the luminosity value from said brilliance control circuit 12 may be emitted.

[0043] And the reflectance of outdoor daylight according [on this field light equipment and] to said outdoor daylight reflective surface 3a (reflectance of the

effective film 3), The luminosity control condition of said illumination light by said lighting Sub-Division luminosity control means 10 is set up so that the luminosity of the light emitted ahead of field light equipment may serve as a luminosity range beforehand defined according to the illumination of external environment.

[0044] The above-mentioned field light equipment reflects the outdoor daylight which enters from the front while emitting the illumination light from said light source 5 ahead, and is emitted ahead, and said light source 5 is turned on when the outgoing radiation light of luminosity sufficient by just the catoptric light of the outdoor daylight which enters from the front is not obtained.

[0045] First, if the outgoing radiation course of the illumination light from a light source 5 is explained, in that course, the illumination light from said light source 5 will be taken into drawing 1 from that incidence **** 1a by said transparent material 1, as the solid line showed, and the inside of this transparent material 1 will be led to it in that length direction.

[0046] And the light which goes to either of two or more level difference sides 2b of the front of a transparent material directly among the illumination light to which the inside of said transparent material 1 is led toward the length direction is emitted to the front side of a transparent material 1 from the level difference side 2b.

[0047] [moreover, the light which goes to said level difference side 2b toward light 2a other than the light which goes directly, i.e. two or more **** of the front of a transparent material, and the light which progresses toward the back of a transparent material 1] While it is reflected by the reflective film 3 on said **** 2a, and the reflective film 4 on the back of a transparent material, direction is changed and the inside of a transparent material 1 is drawn by the repetition in the length direction, it enters into either of said two or more level difference sides 2b, and is emitted from the level difference side 2b.

[0048] Therefore, most illumination light taken into said transparent material 1 from the incidence **** 1a is emitted from said two or more level difference sides 2b without Ross.

[0049] And the illumination light which acted ahead [of said transparent material 1] as Idei enters into said selection dispersion film 8 which the back was made to counter the front of this transparent material 1, and has been arranged from that back.

[0050] At this time, make said selection dispersion film 8 approach or contact the lip edge of two or more **** 2a of said transparent material 1, it is arranged, and that back [moreover, two or more level difference sides 2b of said transparent material 1] Since it has faced each other from across to the back of said selection diffusion film 8, most light which acted as Idei from two or more level difference sides 2b of said transparent material 1 is taken into the selection dispersion film 8 from the back without Ross.

[0051] [said selection dispersion film 8 / moreover, the gap direction of said transmission axis P over the aforementioned method line / in / as mentioned

above / the front of a film / H] Since it is arranged towards the direction of incidence **** 1a of said transparent material 1 to **** h of two or more **** 1a of said transparent material 1, the illumination light which acted as Idei from two or more level difference sides 2b of said transparent material 1 enters from the direction which intersects said selection dispersion film 8 to the transmission axis P.

[0052] And since it has the selection dispersion characteristic of making the light which enters by the incidence angle in the predetermined angle range ϕ from the direction in alignment with the transmission axis P penetrating, and scattering the incidence light from other directions as said selection dispersion film 8 was shown in drawing 3 , It acts as Idei from two or more level difference sides of said transparent material 1, and most illumination light which entered from the direction which intersects said selection dispersion film 8 to the transmission axis P is scattered about with said selection dispersion film 8, and it is ahead emitted from the front.

[0053] Next, in the course, if the outgoing radiation course of the outdoor daylight which enters from the front is explained, the outdoor daylight which entered from the front will be taken into said selection dispersion film 8 from the front by drawing 1 , as the dashed line showed.

[0054] In this case, the inside of the outdoor daylight which enters from the front of said selection dispersion film 8 since outdoor daylight enters by various incidence angles from various directions, The outdoor daylight which penetrated the outdoor daylight which entered by the incidence angle in the predetermined angle range ϕ from [of this selection dispersion film 8] transmission-axis P, without scattering about said selection dispersion film 8, acted to that back as Idei, and entered from other directions is scattered about with said selection dispersion film 8, and is emitted to that back.

[0055] [and the light which penetrated, without scattering about said selection dispersion film 8, and acted to the back as Idei] It is reflected by the outdoor daylight reflective surface 3a on two or more **** 2a of said transparent material 1, direction is changed, and it enters from the direction which intersects said selection dispersion film 8 to that transmission axis P, is scattered about with this selection dispersion film 8, and is emitted to that front.

[0056] Moreover, although the light which entered from the direction besides the above, was scattered about with said selection dispersion film 8, and acted to the back as Idei does not show the course in a figure, it is reflected in the various directions by said outdoor daylight reflective surface 3a, and the catoptric light emits it to the front in response to a dispersion operation of said selection dispersion film Optical Control Sub-Division board.

[0057] [in addition, the light which was scattered about with said selection dispersion film 8, and acted to the back as Idei] Since it enters into said outdoor daylight reflective surface 3a by various incidence angles and is reflected in the various directions according to the incidence angle to this reflective surface 3a, in

hat catoptric light There is also light which enters from [the] transmission-axis by the incidence angle in the predetermined angle range ϕ to said selection dispersion film 8, and the catoptric light is penetrated without scattering about said selection dispersion film 8, and is emitted to the front.

[0058] In a reflection of the above-mentioned outdoor daylight, / said outdoor daylight reflective surface 3a Since it is formed with the reflective film 3 prepared over the whole ****, respectively on two or more **** 2a of said transparent material 1, most outdoor daylight which enters from the front of said selection dispersion film 8 can be reflected without loss, and the catoptric light can be emitted from the whole front of said selection dispersion film 8.

[0059] Namely, [the film] although said reflective film 3 is formed only on two or more **** 2a of said transparent material 1 **** the level difference side 2b between said two or more **** 2a rises **** from 90 degrees or it at a slightly large angle to said **** 2a — since it is the standup side of small height preparing on two or more **** 2a, respectively — the interval of the reflective film 3 of **** plurality — **** — most outdoor daylight into which it is small, therefore said outdoor daylight reflective surface 3a enters from the front is reflected.

[0060] In addition, although it enters from the front, and the light emitted toward the level difference side 2b of said transparent material 1 from the back of this selection dispersion film 8 is also in the outdoor daylight scattered about with said selection dispersion film 8 and that light enters into a transparent material 1 from said level difference side 2b It is reflected by said reflective film 4 in the back of a transparent material 1, it acts as Idei of the outdoor daylight which entered into this transparent material 1 from either of said two or more level difference sides 2b, and it is ahead emitted with the catoptric light by said outdoor daylight reflective surface 3a.

[0061] [thus, the outdoor daylight which the above-mentioned field light equipment enters from that front, is taken into said selection dispersion film 8 from that front and is emitted to the back of this selection dispersion film 8] While reflecting according to the outdoor daylight reflective surface 3a on two or more **** 2b of said transparent material 1, taking the catoptric light into said selection dispersion film 8 from the back and being ahead emitted from the front Take the illumination light from said light source 5 into said transparent material 1 from that incidence **** 1a, act as Idei from two or more level difference sides 2b of this transparent material 1, and that light is taken into said selection dispersion film 8 from that back. You make it scattered about with this selection dispersion film 8, and it is ahead emitted from that front, and according to this field light equipment, while emitting the illumination light from a light source 5 ahead, the outdoor daylight which enters from the front can be reflected and it can be emitted ahead.

[0062] When [therefore,] the outdoor daylight of sufficient brightness is obtained according to this field light equipment When it acts as Idei only of the catoptric

ght of outdoor daylight, without making a light source 5 turn on and the brightness of outdoor daylight runs short When the shortage of luminosity of the catoptric light of outdoor daylight is compensated by said illumination light and outdoor daylight is not obtained by making said light source 5 turn on and emitting both illumination light from the catoptric light and said light source 5 of outdoor daylight, the illumination light from said light source 5 can be emitted.

[0063] And said selection dispersion film 8 has the transmission axis P which meets the direction which inclined in the predetermined direction at an angle of θ [theta] predetermined to the **** H, as mentioned above. The light which enters by the incidence angle in the predetermined angle range ϕ from the direction in alignment with said transmission axis P is made to penetrate. Have the selection dispersion characteristic of scattering the incidence light from other directions, and [this selection dispersion film 8] Since the gap direction of said transmission axis P over the aforementioned method line H in the front of a film is arranged at the front side of said transparent material 1 towards the direction of incidence **** 1a of said transparent material 1 to **** h of two or more **** 2a of said transparent material 1, The illumination light which it is taken into said transparent material 1 from that incidence **** 1a, and is emitted from two or more level difference sides 2b of this light guide plate 1 enters from the direction which intersects said selection dispersion film 8 to that transmission axis P.

[0064] Therefore, according to the above-mentioned field light equipment, most illumination light emitted from two or more level difference sides 2b of said transparent material 1 can be scattered with said selection dispersion film 8, and it can be ahead emitted from the front.

[0065] [moreover, the light which acted to the back of said selection dispersion film 8 as Idei without being entered and scattered about by the incidence angle in the predetermined angle range ϕ from / of this selection dispersion film 8 / transmission-axis P from the front of said selection dispersion film 8 among the entering outdoor daylight] While it is reflected by said outdoor daylight reflective surface 3a, changing direction, entering from the direction which intersects said selection dispersion film 8 to that transmission axis P, being scattered about with this selection dispersion film 8 and being emitted to that front Since it is scattered about with said selection dispersion film 8, and it acts to the back as Idei, it is reflected in the various directions by said outdoor daylight reflective surface 3a and the outdoor daylight which entered from other directions is emitted to the front in response to a dispersion operation of said selection dispersion film 8, Most outdoor daylight which enters from the front can be scattered, and it can be emitted ahead.

[0066] Therefore, according to the above-mentioned field light equipment, the illumination light from a light source 5 and the catoptric light of the outdoor daylight which enters from the front can be diffused broadly, and it can act ahead as Idei, and they can make large luminance distribution of the outgoing radiation light.

[0067] [furthermore, the illumination light which was taken into said transparent material 1 from the incidence **** 1a according to the above-mentioned field light equipment] Since it is made to act as Idei from said two or more level difference sides 2b of the front of this transparent material 1, the reflective film 3 is formed on several different **** 2a from said two or more level difference sides of said transparent material 1 and said outdoor daylight reflective surface 3a is formed, The outgoing radiation rate of the illumination light which it acts as Idei from said light source 5, it is led by said transparent material 1, and is emitted from said two or more level difference sides 2b, While it is possible to choose uniquely the reflectance of the outdoor daylight by said outdoor daylight reflective surface 3a, respectively, therefore making high the outgoing radiation rate of said illumination light and raising the use efficiency of the illumination light from a light source 5, reflectance of the outdoor daylight by said outdoor daylight reflective surface 3a can be made high, and the use efficiency of outdoor daylight can be raised.

[0068] Moreover, the reflectance of outdoor daylight make a Lighting Sub-Division luminosity control means 10 to control the luminosity of the illumination light emitted to said light source 5 from this light source 5 in the above-mentioned field light equipment have, and according to said outdoor daylight reflective surface 3a, Since the luminosity control condition of said illumination light by said Lighting Sub-Division luminosity control means 10 is set up so that the luminosity of the light emitted ahead of field light equipment may serve as a luminosity range beforehand defined according to the illumination of external environment, In the environment of the large illumination range of high illumination, the light of suitable luminosity can be emitted from low illumination to the environmental illumination.

[0069] namely, it changes with illumination of external environment, and even when the suitable luminosity of the outgoing radiation light which field light equipment emits has the the same luminosity of outgoing radiation light, it is too dark in outgoing radiation light being too dazzling depending on environmental illumination.

[0070] Therefore, in this example [the reflectance (reflectance of the reflective film 3) of said outdoor daylight reflective surface 3a] for example, the direct rays of a summer -- [catoptric light / of the outdoor daylight which sets up so that the outgoing radiation light of the suitable luminosity which is not too dazzling may be obtained also under the environment over the following 100000 luxs of high illumination, and is reflected by said outdoor daylight reflective surface 3a] Outgoing radiation luminosity by both illumination light from said light source 5 (however, when environmental illumination is almost 0 lux) He is trying for the outgoing radiation luminosity only by the illumination light to control the luminosity of the illumination light which acts as Idei by said Lighting Sub-Division luminosity control means 10 according to environmental illumination from said light source 5 to become the suitable luminosity according to environmental illumination.

[0071] Also when [therefore,] emitting only the catoptric light of outdoor daylight

According to the above-mentioned field light equipment, without making a light source 5 turn on in the environment where the outdoor daylight of sufficient brightness is obtained. Also when compensating the shortage of luminosity of the catoptric light of outdoor daylight with said Lighting Sub-Division by making said light source 5 turn on in the environment which runs short of the brightness of outdoor daylight, and emitting both illumination light from the catoptric light and said light source 5 of outdoor daylight. Moreover, also when emitting the illumination light from said light source 5 in the environment where outdoor daylight is not obtained, according to the illumination of said environment, the light of suitable luminosity can be emitted to the environmental illumination.

[0072] And even if the above-mentioned field light equipment does not make a light source 5 turn on in the environment where the outdoor daylight of sufficient brightness is obtained, it can emit the light of suitable luminosity to environmental illumination only by the catoptric light of outdoor daylight. Also when [moreover,] compensating the shortage of luminosity of the catoptric light of outdoor daylight with said Lighting Sub-Division by making said light source 5 turn on in the environment which runs short of the brightness of outdoor daylight, and emitting both illumination light from the catoptric light and said light source 5 of outdoor daylight. In order that the outgoing radiation luminosity by both the catoptric light of outdoor daylight and said illumination light may just control the luminosity of the illumination light which acts as Idei from said light source 5 to become suitable luminosity to environmental illumination, there may be little power consumption of said light source 5.

[0073] The above-mentioned field light equipment is what is used for 2 way display device which displays both the reflected type display using outdoor daylight, and the penetrated type display using the illumination light from field light equipment, for example. Since this field light equipment is what can reflect the outdoor daylight which enters from the front and can be emitted ahead while emitting the illumination light from a light source 5 ahead, it can constitute said 2 way display device, without using a transflective light reflector.

[0074] Namely, what is necessary is just to arrange the nonluminescent type display objects 15, such as a liquid-crystal-display element, to the front side of this field light equipment at drawing 1, as the imaginary line (two-dot chain line) showed when it constitutes 2 way display device using the above-mentioned field light equipment.

[0075] Since this 2 way display device does not need a transflective light reflector, it can use efficiently the illumination light from field light equipment, and the outdoor daylight which enters from the front, and can display a bright picture.

[0076] [namely, 2 way display device using a transflective light reflector] The illumination light from field light equipment penetrates this transflective light reflector with the transmissivity according to reflection/penetration characteristic of said transflective light reflector, and enters into a display object from that back. Moreover, since the outdoor daylight which entered from the front of said

display object penetrates this transfective light reflector with the reflectance according to reflection/penetration characteristic of said transfective light reflector and enters into said display object from that back, neither the illumination light from field light equipment nor the outdoor daylight which enters from the front can be used efficiently.

[0077] [on the other hand, 2 way display device using the field light equipment of the above-mentioned example] [light equipment] theoretically while said field light equipment emits the light from a light source 5 at the outgoing radiation efficiency of about 100% Since it does not reflect at the reflective efficiency of about 100% and the outdoor daylight which enters from the front moreover does not need a transfective light reflector, either, the illumination light from field light equipment and the outdoor daylight which enters from the front can be used efficiently, and can display a bright picture.

[0078] Moreover, since said field light equipment emits the illumination light from a light source 5, and the catoptric light of the outdoor daylight which enters from the front as a large light of luminance distribution, this 2 way display device has a large angle of visibility.

[0079] In addition, for convenience, although the echelon form-like side 2 of the transparent material 1 was expanded greatly and shown, the smaller one of the pitch of the level difference side 2b of said echelon form-like side 2 is good in drawing 1 .

[0080] That is, when using a dot matrix type liquid-crystal-display element for said nonluminescent type display object 15, for example, it is desirable for it to be almost the same as the pixel pitch of said liquid-crystal-display element, or to increase the pitch of the level difference side 2b of the echelon form-like side 2 of said transparent material 1 about several times of a pixel pitch.

[0081] Since the illumination light from a light source 3 will act as I_{dei} in the above-mentioned pitch from two or more level difference sides 2b of said transparent material 1, the light will be scattered about with the selection dispersion film 8, it will become the light of almost uniform luminance distribution and it will be emitted, if it does in this way, All the picture element parts of said liquid-crystal-display element can be entered, and a good picture without the chip omission of a pixel can be displayed.

[0082] moreover, [said 2 way display device] under the environment where outdoor daylight is obtained like the usual high-reflective-liquid-crystal display device Direction of a screen is used choosing so that outdoor daylight may mainly be taken in from the direction which inclined to the superior border side (it is [in / a figure is carried out and / 1] left-hand side) of a screen to **** of a screen, and the display is observed from the direction which inclined in the direction of an inferior border of a screen (it is the right in drawing 1) 5 to 60 degrees to **** of said screen.

[0083] When [therefore,] it constitutes 2 way display device using the above-mentioned field light equipment It is desirable to design field light equipment so

that the main outgoing radiation directions of the catoptric light (dispersion light) of outdoor daylight may become in the direction which inclined to one way 5 to 60 degrees to **** H of said selection dispersion film 8, and to arrange this field light equipment towards the observation direction of a display of the main outgoing radiation directions of the catoptric light of that outdoor daylight of a display device.

[0084] That is, the main outgoing radiation directions of the catoptric light which is reflected by said outdoor daylight reflective surface 3a, is scattered about with said selection dispersion film 8, and is emitted to the front in the above-mentioned field light equipment are decided by direction of the transmission axis P of said selection dispersion film 8, and the inclination angle of said outdoor daylight reflective surface 3a.

[0085] [and the gap direction of the transmission axis P over **** H of the selection dispersion film / in / as shown in drawing 2 / for said selection dispersion film 8 / the front / 8] When arranging towards the direction of incidence **** 1a of said transparent material 1 to **** h of two or more **** 2a of said transparent material 1 For example, the inclination angle theta of said transmission axis P over **** H of said selection dispersion film 8 is carried out within the limits of 40 to 80 degrees. In the outdoor daylight reflective surface 3a which consists of a reflective film 3 prepared on two or more **** 2b of said transparent material 1, the back of said selection dispersion form 8 is received. It is made to incline so that an interval with the back of said selection dispersion film 8 may be narrowed toward the direction which keeps away from incidence **** 1a of said transparent material 1. If the inclination angle alpha of said outdoor daylight reflective surface 3a over **** H of said selection dispersion film 8 is set up within the limits of 60 to 80 degrees [the catoptric light of said outdoor daylight] while making it mainly act in the **** direction by the side of opposite to drawing 2 as Idei of the main outgoing radiation direction in incidence **** 1a of said transparent material 1 to **** H of said selection dispersion film 8 as the dashed line F showed The Idei angle (angle to **** H of the selection dispersion film 8) gamma can be made into the range of 5 to 60 degrees.

[0086] [in addition, the inclination angle alpha of said outdoor daylight reflective surface 3a over **** H of said selection dispersion film 8] Since it has an $\alpha + \beta = 90$ degree relation to the inclination angle (gap angle of **** H of the selection dispersion film 8, and **** h of the outdoor daylight reflective surface 3a) beta of said outdoor daylight reflective surface 3a over the back of said selection dispersion film 8, What is necessary is to lean 10–30 degrees of the **** H to a counter direction in incidence **** 1a of said transparent material 1 to **** h of two or more **** 2a of said transparent material 1, and just to arrange said selection dispersion film 8, in order to make it make it mainly act in the above-mentioned direction as Idei of the catoptric light of outdoor daylight.

[0087] Furthermore, the reflectance of outdoor daylight said field light equipment makes a Lighting Sub-Division luminosity control means 10 to control the

luminosity of the illumination light emitted to a light source 5 from this light source 5 have, and according to said outdoor daylight reflective surface 3a, In order to set up the luminosity control condition of said illumination light by said Lighting Sub-Division luminosity control means 10 so that the luminosity of the light emitted ahead of field light equipment may serve as a luminosity range beforehand defined according to the illumination of external environment, The above-mentioned 2 way display device using this field light equipment can obtain the display of suitable screen luminosity from low illumination to that environmental illumination in the environment of the large illumination range of high illumination.

0088] In addition, in the above-mentioned 2 way display device, the outdoor daylight which enters from the front penetrates said display object 15, and enters into field light equipment. Moreover, outgoing radiation light from said field light equipment ([illumination light / the catoptric light of outdoor daylight, or / the catoptric light of said outdoor daylight and the illumination light from a light source 5 / both] in the environment where outdoor daylight is obtained) In the environment where outdoor daylight is not obtained, since the illumination light from a light source 5 penetrates said display object 15 and is emitted ahead of the], screen luminosity is decided by the reflectance of the outdoor daylight by the outdoor daylight reflective surface 3a of said field light equipment and the luminosity of the illumination light from a light source 5, and transmissivity of said display object 15.

0089] Therefore, what is necessary is just to set up the reflectance of the outdoor daylight by said outdoor daylight reflective surface 3a, and the luminosity control condition of said illumination light by said Lighting Sub-Division luminosity control means 10 so that said screen luminosity may serve as a luminosity range in which it was beforehand provided according to the illumination of external environment when using said field light equipment for 2 way display device.

0090] [namely, the suitable screen luminosity according to environmental illumination] For example, it is 400 to 4000 knitting at environmental illumination of 1000 luxs like the interior of a room at the time of making 20 to 200 knitting, and the interior illumination in daytime or the night turn on with environmental illumination of 50 luxs like streetlight-izing at night in 30 to 300 knitting, and environmental illumination of 30000 luxs like the shade of a tree at the time of fine weather.

0091] When [therefore,] using said field light equipment for 2 way display device the luminosity of the illumination light from said light source 5 / with the Lighting Sub-Division luminosity control means 10 / the screen luminosity to environmental illumination] What is necessary is just to control according to environmental illumination to become the luminosity expressed with the quadratic function which is satisfied with the environmental illumination of 50 luxs of the range of 400 to 4000 knitting with 20 to 200 knitting, and the environmental illumination of 1000 luxs at 30 to 300 knitting, and the environmental illumination

of 30000.luxs, respectively.

[0092] In addition, although the reflective film 4 is formed in the back of the transparent material 1 in the above-mentioned example The reflective film 4 of this back may be omitted, even if this reflective film 4 does not exist, can carry out total internal reflection of the illumination light taken into said transparent material 1 from that incidence **** 1a by the interface of the transparent material back and the open air (air), and can be led in the length direction of a transparent material 1.

[0093] Moreover, although the selection dispersion film 8 which has the selection dispersion characteristic shown in drawing 2 as an Optical Control Sub-Division board arranged to the front side of a transparent material 1 was used in the above-mentioned example While said Optical Control Sub-Division board's taking in from the front said not only selection dispersion film 8 but the outdoor daylight which enters from the front, and acting to the back as Idei of it, taking in the catoptric light of said outdoor daylight reflected by said outdoor daylight reflective surface 3a from the back and emitting it to the front What is necessary is to take in from the back the illumination light emitted from two or more level difference sides 2b of said transparent material 1, and just to have the function which the light is scattered and is emitted to the front.

[0094] Drawing 4 is some side views of other Optical Control Sub-Division boards, and this Optical Control Sub-Division board 9 consists of an optical louver-like film. This Optical Control Sub-Division board 9 is hereafter called louver film.

[0095] The two or more rows oblong photic region 9a to which this louver film 9 was along one way is mutually formed in parallel considering the filmy scattering layer 9b as a boundary layer. The interface of the both-sides side of each of that photic region 9a and said scattering layer 9b forms a slope which inclined in the predetermined direction by predetermined angle theta' to **** H' of a film, respectively. In addition, said photic region 9a consists of colorless transparent resin etc., and said scattering layer 9b consists of white transparent resin etc.

[0096] This louver film 9 has transmission-axis P' which met in the inclination direction of the interface of the both-sides side of said photic region 9a, and said scattering layer 9b. It acts as Idei, without scattering the light which enters into said photic region 9a by incidence angle phi' of predetermined angle within the limits from [the] transmission-axis P', and has the characteristic of scattering the light which enters into said photic region 9a from other directions by said scattering layer 9b, and emitting it.

[0097] Also as opposed to the light which this louver film 9 enters from the field of one of these, and is emitted to the field of another side As the same dispersion characteristic is shown also to the light which enters from the field of said another side and is emitted to one [said] field and the arrow showed to drawing 4 The straight line passing through the one end edge (edge by the side of the front of a film) of one scattering layer 9b of the scattering layers 9b which adjoin said photic region 20 from the direction in alignment with said transmission-axis

P', and the other end edge (edge by the side of the film back) of the scattering layer 9b of another side, Make it penetrate, without scattering the light which enters by incidence angle ϕ_i of the angle range which the straight line passing through the other end edge (edge by the side of the film back) of one [said] scattering layer 9b and the one end edge (edge by the side of the front of a film) of the scattering layer 9b of another side makes, and it acts to an opposite side as Idei. The incidence light from other directions is scattered and it is emitted to an opposite side.

[0098] [said louver film 9] while making the film back approach or contact the tip edge of two or more **** 2a of that echelon form-like side 2 at the front side of a transparent material 1 as well as the above-mentioned example when using this louver film 9 What is necessary is just to arrange the gap direction of said transmission-axis P' to aforementioned method line H' in the front of a film towards the direction of incidence **** 1a of said transparent material 1 to **** of two or more **** 2a of said transparent material 1.

[0099] Thus, if said louver film 9 is arranged as mentioned above to a transparent material 1 Since the illumination light which it is taken into said transparent material 1 from the incidence **** 1a, and is emitted from said two or more level difference sides 2b enters from the direction which intersects said louver film 9 to the transmission-axis P', Most illumination light emitted from two or more level difference sides 2b of said transparent material 1 can be scattered with said louver film 9, and it can be emitted ahead.

[0100] [moreover, the light which acted to the back of said louver film 9 as Idei without being entered and scattered about by incidence angle ϕ_i of predetermined angle within the limits from / of this louver film 9 / transmission-axis P' from the front of said louver film 9 among the entering outdoor daylight] While it is reflected by said outdoor daylight reflective surface 3a, changing direction, entering from the direction which intersects said louver film 9 to that transmission-axis P', being scattered about with this louver film 9 and emitted to that front Since it is scattered about with said louver film 9, and it acts to the back as Idei, it is reflected in the various directions by said outdoor daylight reflective surface 3a and the outdoor daylight which entered from other directions is emitted to the front in response to a dispersion operation of said louver film 9, Most outdoor daylight which enters from the front can be scattered, and it can be emitted ahead.

[0101] Therefore, the illumination light from said light source 5 and the catoptric light of the outdoor daylight which enters from the front can be diffused broadly, and it can act ahead as Idei, and they can make large luminance distribution of the outgoing radiation light.

[0102] [moreover, the main outgoing radiation directions of the catoptric light which is reflected by said outdoor daylight reflective surface 3a, is scattered about with said louver film 9 and emitted to the front also when using said louver film 9] Although decided by direction of transmission-axis P' of said louver film 9,

and the inclination angle of said outdoor daylight reflective surface 3a When said louver film 9 is arranged as mentioned above to said transparent material 1, For example, carry out the inclination angle of said transmission-axis P' to **** H' of said louver film 9 within the limits of 40 to 80 degrees, and the back of said louver film 9 is received in said outdoor daylight reflective surface 3a. It is made to incline so that an interval with the back of said louver film 9 may be narrowed toward the direction which keeps away from incidence **** 1a of said transparent material 1. If the inclination angle of said outdoor daylight reflective surface 3a over **** H' of said louver film 9 is set up within the limits of 60 to 80 degrees It can be made to mainly act in the direction which inclined in the **** direction by the side of opposite 5 to 60 degrees as Idei of the catoptric light of said outdoor daylight in incidence **** 1a of said transparent material 1 to **** H' of said louver film 9.

[0103] Moreover, although the reflective film 3 is formed on two or more **** 2a of a transparent material 1 and the outdoor daylight reflective surface 3a is formed with these reflective films 3 in the 1st example of the above, as long as the reflective surface of outdoor daylight is a field which is different in two or more level difference sides 2b which are illumination-light Idei sides of said transparent material 1, you may form it in other fields.

[0104] Drawing 5 is the 2nd example of this invention the side view of the shown field light equipment, and [this example] The ** which does not prepare a reflective film on two or more **** 2a of the echelon form-like side 2 of said light guide plate 1, These **** 2a are made into an optical penetration side, it migrates to that whole back, the specular reflexion film 4 which consists of a vapor deposition film of high reflectance metal, such as aluminum or silver, is formed in the back of said transparent material 1, and the outdoor daylight reflective surface 4a is formed in it with this reflective film 4.

[0105] In addition, although this example makes two or more **** 2a of a light guide plate 1 an optical penetration side and the outdoor daylight reflective surface 4a is formed in the back of said transparent material 1 It is the composition as said 1st example also with same light source 5 and Lighting Sub-Division luminosity control means 10 as the 1st example mentioned above in which other composition of said transparent material is the same. Furthermore, since the Optical Control Sub-Division board arranged to the front side of a transparent material 1 is also the selection dispersion film 8 or the louver film 9 mentioned above, the overlapping explanation attaches and omits a same sign to a figure.

[0106] Since the outdoor daylight reflective surface 4a is formed in the whole back of said transparent material 1 according to the field light equipment of this example, Most outdoor daylight which enters from the front of said Optical Control Sub-Division board (the selection dispersion film 8 or louver film 9) can be reflected that there is not still Ross, and the catoptric light can be emitted from said Optical Control Sub-Division board 8 and the whole front of 9.

0107] Moreover, since the reflective film 4 is formed in a field (transparent material back) which is different in two or more level difference sides 2b which are illumination-light Idei sides of said transparent material 1 also in this example and said outdoor daylight reflective surface 4a is formed, The outgoing radiation rate of the illumination light which it acts as Idei from said light source 5, it is led by said transparent material 1, and is emitted from said two or more level difference sides 2b, While it is possible to choose uniquely the reflectance of the outdoor daylight by said outdoor daylight reflective surface 4a, respectively, therefore making high the outgoing radiation rate of said illumination light and raising the use efficiency of the illumination light from a light source 5, reflectance of the outdoor daylight by said outdoor daylight reflective surface 4a can be made high, and the use efficiency of outdoor daylight can be raised.

0108] In addition, the above-mentioned field light equipment can be widely used as a Lighting Sub-Division panel using not only 2 way display device but the light from the light source arranged to the side, for example, and the outdoor daylight which enters from the front etc.

0109] Furthermore, although the end side of the light guide plate 1 was made into incidence **** 1a in the above-mentioned example A symmetrical-shaped thing is sufficient as said light guide plate 1 across the intermediate part of the length direction which made **** of both ends incidence **** and formed the front in the echelon form-like side which becomes low gradually toward the intermediate part of a transparent material from the both-ends side, for example.

0110] What is necessary is just to arrange the Optical Control Sub-Division board which has the symmetrical dispersion characteristic across the intermediate part of the length direction in the front side of said transparent material and to arrange, while arranging a light source to the side of incidence *** of the both ends of this light guide plate, respectively, when using the transparent material of such composition.

0111]

Effect of the Invention] The transparent material emitted from two or more level difference sides of the front which the field light equipment of this invention took in the illumination light from incidence ****, and was formed in the echelon form-like side, The outdoor daylight reflective surface established in a different field from said level difference side of said transparent material, and the light source which said incidence **** was made to counter the side of said transparent material, and has been arranged, While make the back counter the front of said transparent material, and it is arranged, and taking in the outdoor daylight which enters from the front from the front, acting to the back as Idei, taking in the catoptric light of said outdoor daylight reflected by said outdoor daylight reflective surface from the back and being emitted to the front Since it is characterized by having the Optical Control Sub-Division board which said illumination light emitted from said two or more level difference sides of said transparent material is taken in from the back, and the light is scattered, and is emitted to the front, while

emitting the illumination light from said light source ahead The outdoor daylight which enters from the front can be reflected and it can be emitted ahead.

[0112] When the outdoor daylight of sufficient brightness is obtained according to this field light equipment When it acts as Idei only of the catoptric light of outdoor daylight, without making a light source turn on and the brightness of outdoor daylight runs short When the shortage of luminosity of the catoptric light of outdoor daylight is compensated by said illumination light and outdoor daylight is not obtained by making said light source turn on and emitting both the catoptric light of outdoor daylight, and the illumination light from said light source Since the illumination light from said light source can be emitted, 2 way display device which displays both the reflected type display using outdoor daylight and the penetrated type display using the illumination light from field light equipment can be constituted without using a transfective light reflector.

[0113] In this field light equipment, [said outdoor daylight reflective surface] By preparing a reflective film on **** of the plurality of said transparent material, respectively, or preparing a reflective film in the whole back of said transparent material It is desirable to form in two or more said **** top or the transparent material back, by doing in this way, most outdoor daylight which enters from the front of said Optical Control Sub-Division board can be reflected without loss, and the catoptric light can be emitted from the whole front of said Optical Control Sub-Division board.

[0114] Furthermore, said Optical Control Sub-Division board has the transmission axis which met in the direction which inclined in the predetermined direction at an angle of predetermined to the ****, for example. What has the selection dispersion characteristic which it acts as Idei, without scattering the light which enters by the incidence angle of predetermined angle within the limits from the direction in alignment with said transmission axis, and the light which enters from other directions is scattered, and is emitted is desirable.

[0115] Moreover, [the board / a scattering layer with an oblong filmy photic region along one way] while two or more rows of said Optical Control Sub-Division board are mutually formed in parallel as a boundary layer The interface of the both-sides side of each of that photic region and said scattering layer forms a slope which inclined in the predetermined direction at an angle of predetermined to **** of said Optical Control Sub-Division board, respectively. It may act as Idei, without scattering the light which enters into said photic region by the incidence angle of predetermined angle within the limits from [which met in the inclination direction of the interface of the both-sides side of said photic region, and said scattering layer] a transmission axis, and may have the characteristic of scattering the light which enters into said photic region from other directions by said scattering layer, and emitting it.

[0116] And when using the Optical Control Sub-Division board which has the characteristic of one of the above, it is desirable to arrange the gap direction of said transmission axis over the aforementioned method line [in / for this Optical

Control Sub-Division board / that front] towards the incidence **** direction of said transparent material to **** of two or more **** of said transparent material.

[0117] Thus, if the Optical Control Sub-Division board which has the characteristic of one of the above is arranged as mentioned above to said transparent material Since the illumination light which it is taken into said transparent material from the incidence ****, and is emitted from said two or more level difference sides enters from the direction which intersects said Optical Control Sub-Division board to the transmission axis, Most illumination light emitted from two or more level difference sides of said transparent material can be scattered with said Optical Control Sub-Division board, and it can be emitted ahead.

[0118] [moreover, the light which acted to the back of said Optical Control Sub-Division board as Idei without being entered and scattered about by the incidence angle of predetermined angle within the limits from / of this Optical Control Sub-Division board / a transmission axis from the front of said Optical Control Sub-Division board among the entering outdoor daylight] While it is reflected by said outdoor daylight reflective surface, changing direction, entering from the direction which intersects said Optical Control Sub-Division board to that transmission axis, being scattered about with this Optical Control Sub-Division board and emitted to that front Since it is scattered about with said Optical Control Sub-Division board, and it acts to the back as Idei, it is reflected in the various directions by said outdoor daylight reflective surface and the outdoor daylight which entered from other directions is emitted to the front in response to a dispersion operation of said Optical Control Sub-Division board, most outdoor daylight which enters from the front can be scattered, and it can be emitted ahead.

[0119] Therefore, the illumination light from said light source and the catoptric light of the outdoor daylight which enters from the front can be diffused broadly, and it can act ahead as Idei, and they can make large luminance distribution of the outgoing radiation light.

[0120] [the directions] although the main outgoing radiation directions of the catoptric light which is reflected by said outdoor daylight reflective surface, is scattered about with said Optical Control Sub-Division board in this field light equipment, and is emitted to that front are decided by direction of the transmission axis of said Optical Control Sub-Division board, and the inclination angle of said outdoor daylight reflective surface When arranging said Optical Control Sub-Division board as mentioned above to said transparent material, the inclination angle of said transmission axis over **** of said Optical Control Sub-Division board is carried out within the limits of 40 to 80 degrees. In the outdoor daylight reflective surface established in a different field from said level difference side of said transparent material, the back of said Optical Control Sub-Division board is received. If it is made to incline so that an interval with the back of said

Optical Control Sub-Division board may be narrowed toward the direction which keeps away from incidence **** of said transparent material and the inclination angle of said outdoor daylight reflective surface over **** of said Optical Control Sub-Division board is set up within the limits of 60 to 80 degrees It can be made so mainly act in the direction which inclined in the **** direction by the side of opposite 5 to 60 degrees to incidence **** of said transparent material as Idei of the catoptric light of said outdoor daylight to **** of said Optical Control Sub-Division board.

[0121] Moreover, the reflectance of outdoor daylight make a Lighting Sub-Division luminosity control means to control the luminosity of the illumination light emitted to said light source from this light source in this field light equipment have, and according to said outdoor daylight reflective surface, When it is desirable to set up so that the luminosity of the light emitted ahead of field light equipment may serve as a luminosity range beforehand defined according to the illumination of external environment and it carries out the luminosity control condition of said Illumination light by said Lighting Sub-Division luminosity control means in this way Also when emitting only the catoptric light of outdoor daylight, without making a light source turn on in the environment where the outdoor daylight of sufficient brightness is obtained Also when compensating the shortage of luminosity of the catoptric light of outdoor daylight by said illumination light by making said light source turn on in the environment which runs short of the brightness of outdoor daylight, and emitting both illumination light from the catoptric light and said light source of outdoor daylight Moreover, also when emitting the illumination light from said light source in the environment where outdoor daylight is not obtained, according to the illumination of said environment, the light of suitable luminosity can be emitted to the environmental illumination.

[Translation done.]

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